March 1948 Vol 9. No 12

Editorial

THE PRICE WILL BE ONE SHILLING

As from the issue of April, the price of Radio & Hobbies will be One Shilling.

The Prices Commission has authorised this increase in price because of the very heavy costs of magazine production in these times.

It has always been our aim to give you the very best magazine in its field which we could produce.

But, during the war, and since, we have had to face a series of difficulties in our endeavors to maintain the standards we set for ourselves.

We thought, when the war ended, that we would be able to go ahead and give our readers the benefit of various progressive developments which we had planned.

But when the national dollar situation became acute, we found we had less newsprint than ever before. Consequently we were forced to reduce the number of pages in this magazine.

Now, however, we have been able to secure some newsprint from sources within the sterling area. These supplies enable us to restore those pages.

Now we have the room in which to demonstrate the improvement we have made in every department of the paper. Now we—editorial and technical staff—will be able to give you wider service, to undertake more projects on a wider scale.

Throughout the world, in the publishing industry, costs have risen tremendously. These increased costs are inescapable. They made necessary the increase in price of Radio & Hobbies to One Shilling, effective as from the next issue, an increase authorised by the Prices Commission.

We, for our part, will continue to give you the largest and most comprehensive journal covering radio, popular science, and hobbies, which Australia produces.

And we promise you that we'll give you more service, more interest, as we progress.

John Moyle

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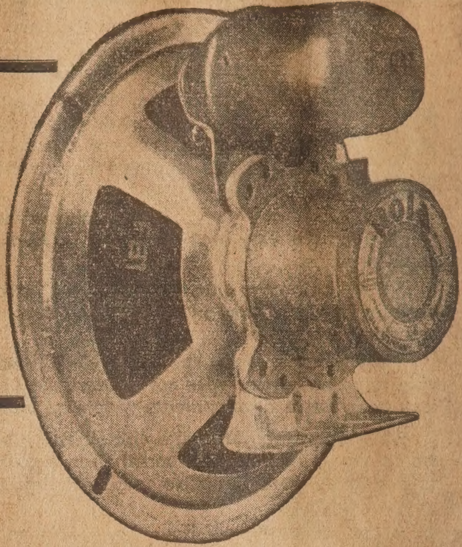
ROLA
PRESENT THEIR NEWEST SPEAKER
MODEL 6K



The new Rola 6K Speaker is the most highly efficient 6" Speaker available in Australia. Specially designed to provide the extra speaker efficiency required by portable, battery, and vibrator operated receivers. Can be used in A.C. receivers if desired.

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Rola 6K Speakers are now becoming available to and through the Trade

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ANISOTROPIC ALNICO

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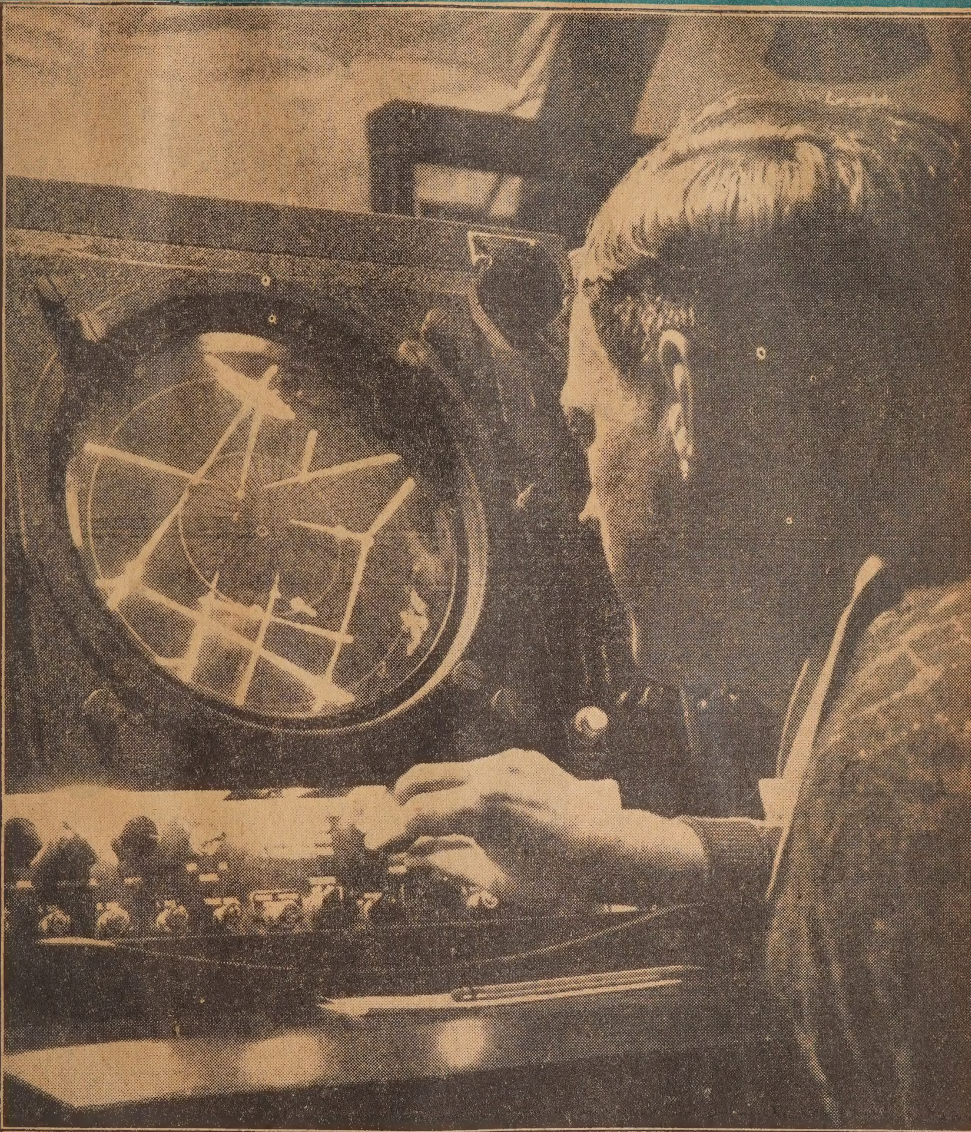
RADAR FLYING CONTROL IN ACTION



AN example of Navigational Radar is seen in this experimental equipment installed near la Guardia Airport in USA. Over the face of the radar screen is placed a "map" showing the air routes in the vicinity of the airport. Aircraft are shown as dots of light moving along bright lines on the skyways map. This visual representation is expected to present a means of controlling air traffic, not only to prevent collision but to save time in handling the high density of aircraft movement. Our cover picture shows the radar tower at the left which determines the elevation of any aircraft at which the antenna is aimed, while the 100ft. tower at the right searches over a 30-mile radius to pinpoint aircraft within that range,

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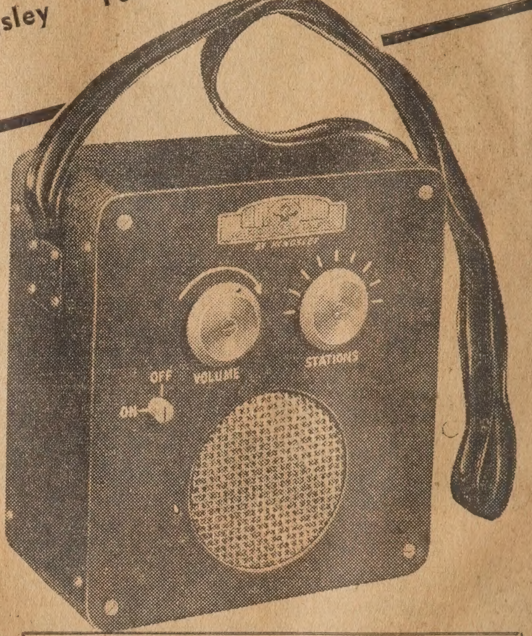

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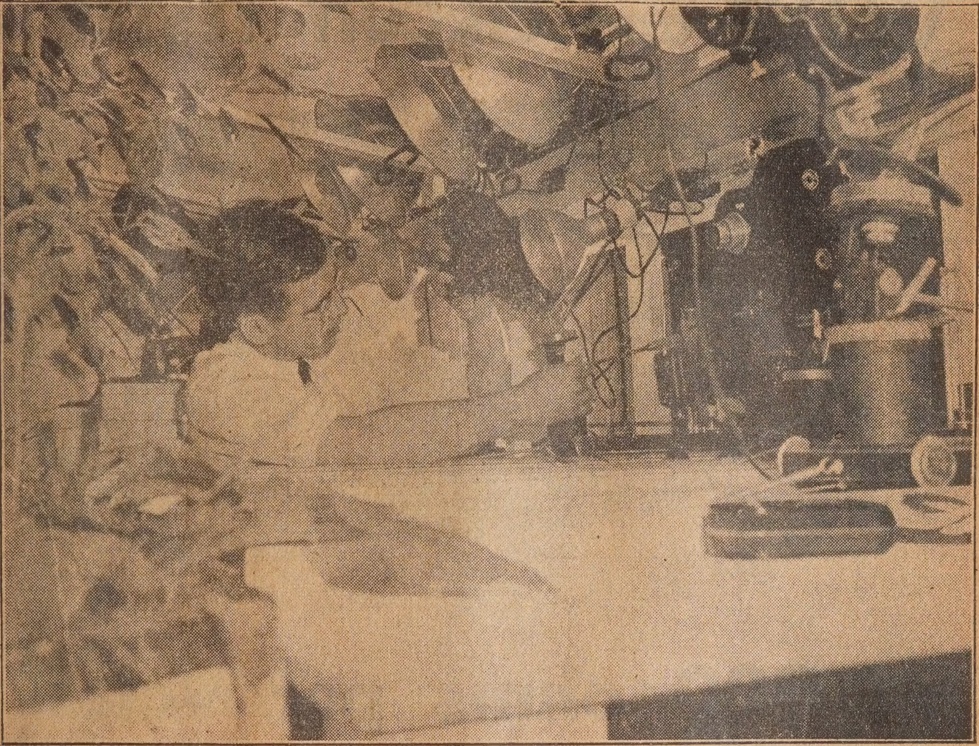
FILMING THE PRIVATE LIFE OF FLOWERS



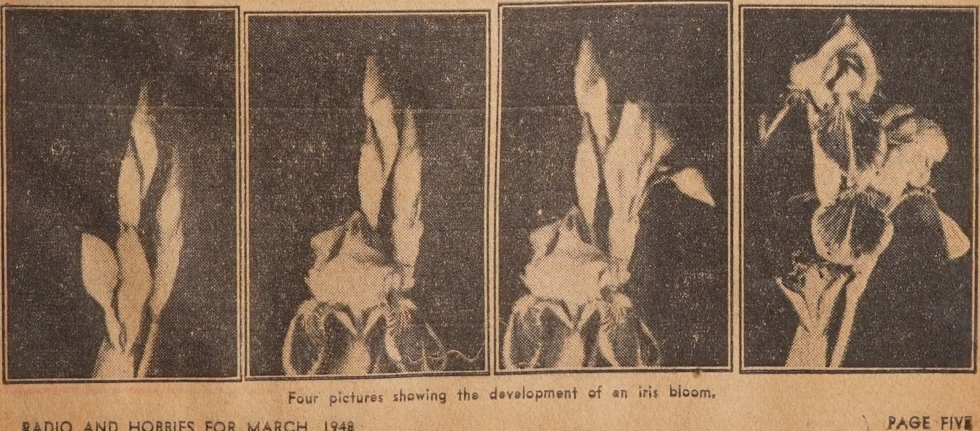
Making adjustments to the camera set-up. Operation is automatic and fully controllable.

THE private life of flowers and weeds has now been exposed to public view through the photographic work of John Nash Ott, jun., Chicago banker, who developed his hobby into a new and well paying profession.

Mr. Ott's photographic technique involves exposing single frames of 16mm film at specified intervals, usually three minutes to the hour. When the film is printed and projected, the rate of plant growth is multiplied thousands of times on the screen. The process is just the reverse of slow motion photography.

One of Mr. Ott's best known productions, only a few feet of film which took five years to make is called "Flowers In Action." Another production is a color sequence "Ballet of the Primroses," in which the movement of the flowers is synchronised with the music of a Strauss waltz. The floral dancing effect was obtained through alternate watering and wilting of the flowers.

Time-lapse photography has many industrial uses, such as the study of chemical reaction of fertilisers, weed controls and plant medicines



Four pictures showing the development of an iris bloom.

THE *NEW* PALEC
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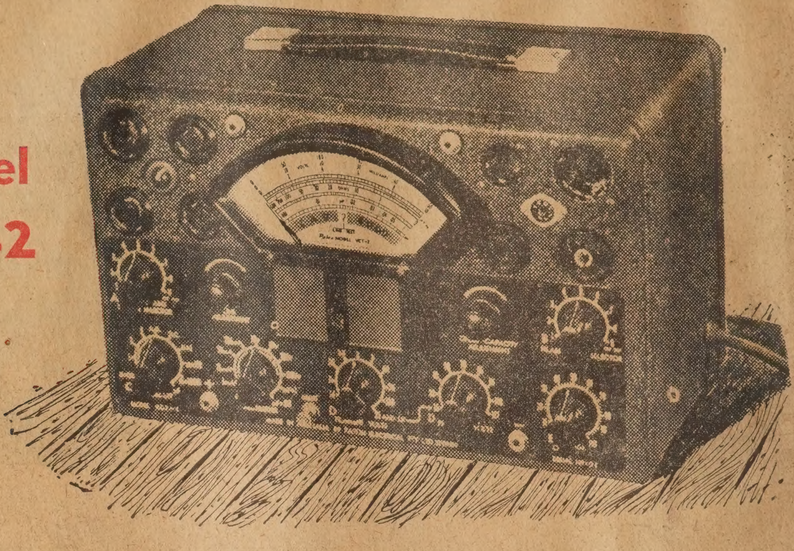
Model VCT-2



10,000 ohms per volt

This new Valve and Circuit Tester, Model VCT-2, should prove a worthy successor to the well known Model VCT. The latter, since its inception in 1937, proved to be the most popular and best selling radio test instrument ever marketed in Australia. The Model VCT-2 is A.C. operated 200-260 volts and can be operated from battery by using an external vibrator unit.

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P21-FP

SCIENTISTS OPEN A WINDOW IN THE CLOUDS

This photograph shows a path made though ice-forming cloud by an aircraft fitted with cloud de-icing equipment.

Although not much has been heard recently of rain-making, considerable thought has been given in various parts of the world to the task of putting present-day techniques to work. Well-known American scientist, Dr. Irving Langmuir, recently presented a report to the US Defence authorities concerning project "Cirrus," a program for research into weather control.

DR. LAMGMUIR was sufficiently optimistic to prophesy that the technique now used to cause rain or snow to fall from suitable cloud formations could be used to bring about widespread climatic changes, particularly in the winter time.

He considered that it was possible to reduce the severity of thunderstorms, virtually eliminate the fall of hail, induce snow and rain falls, particularly over catchment areas and other places where rain is vital, control the development of cloud forms to avoid icing conditions for aircraft, and so on.

These are things which appear possible in the near future.

The prevention of icing on aircraft would be a valuable assistance to aviation.

Attacking dangerous, ice-forming clouds with dry ice, perhaps in the form of bullets shot ahead of the plane, will clear a safe path through the clouds, flight experiments have proved.

A plane flying over an icing cloud should be able to clear a hole through the cloud in 15 minutes with a bombardment of dry ice, it was reported. In taking off, the plane would "seed" the lower layer of the cloud with dry ice to clear a path up through the dangerous cloud.

Attempts to change the cloud formations over an area such as the northern US will have to wait for research development and experiments.

"Obviously," Dr. Langmuir point out, "experiments producing widespread effects should be made in relatively unpopulated regions such as Alaska or northern Canada."

First experiments in converting a supercooled cloud to snow were in the General Electric Research Laboratory by Vincent J. Schaefer in July, 1946. Mr. Schaefer is now working with Dr. Langhuir in directing the cloud study.

In addition to the flights and laboratory experiments made, fiv new flights are planned to attemp various new artificial weather operations. In one experiment, the scientists will attempt to produce cloud in clear air.

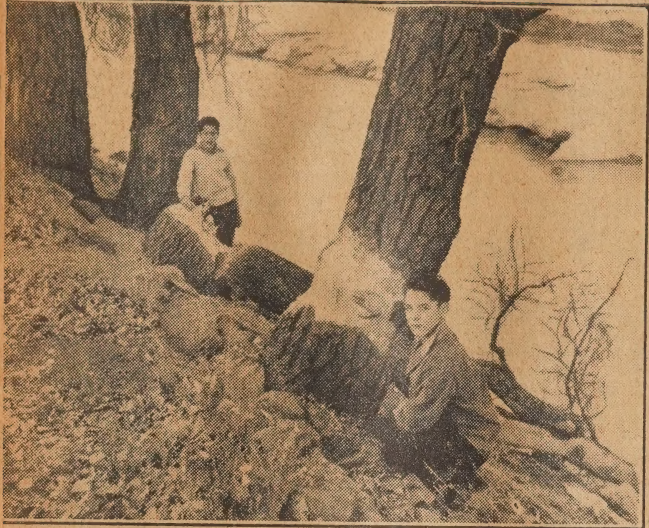
Whether or not scientists are abl to tailor-make weather, the clou experiments are revealing new fact which will help meteorologists predict weather more accurately.

Wartime smoke generators usin silver iodide instead of smoke migh be used on the ground for large scale cloud changes, the scientis suggests. Use of silver iodide instea of dry ice is being studied by anothe General Electric scientist, Dr. Bernard Vonnegut. "Many other substances" may be found for this attac on clouds, the report predicts.

Dry ice dropped over beginnin thunderstorms as soon as the top reach freezing level can now produc less severe storms, Dr. Langmuir explains. This would also prevent hai which claims an estimated annua damage of 15,000,000 dollars on far crops.

Over mountain areas, dry ice migh be seeded on clouds to produc greater snowfall. This snow, whic would fall as rain from the lowe layers of clouds, might end the plagu of dry years in irrigated valleys,

MAN'S GREAT ENGINEERING PROJECTS



This picture shows a tree ringbarked by beavers, and a second which has actually been felled. They were to be used in damming this stream near Denver, Colorado.

Throughout the vast realms of Nature there is ample evidence to prove that it is not man alone who is condemned to work by the sweat of his brow. Every living thing, plant, animal and insect, must do some kind of work in order to eke out a living and in many cases this work is hard and consistent. Food must be obtained, homes must be built as protection for the young and as sanctuary against invaders.

by Calvin Walters

NATURE, at once harsh, and benevolent, has provided all living ings with the means of carrying ut certain duties and has also lotted these duties in accordance ith necessity and environment.

It is true that in the animal, inct and plant kingdoms, as in the man race, there are those who do t like work and attempt to live the labors of their fellows. These tcasts are suitably dealt with by eir neighbors whose methods are uch harder than the methods of e human family.

NIMAL HOMES

Among the most remarkable acmplishments of the animal kingm is the constructional work done the erection of homes. Here we nd that in most cases structural rms are used which are truly asunding, and bear striking resembnce to many used by man.

Probably one of the most marvelus of these "constructional anials" is the beaver. This animal, longing as it does to other counies, and non-existent in Australia, s escaped the attention of most of , and what we know of it has been arned through the medium of hool books and stories.

Beavers are social animals and ve in homesteads with about six animals to the homestead. Their home may be a simple burrow in the bank of a stream or lake, with the mouth of the burrow opening out under the water.

BEAVER "LODGE"

This type of home seems to be favored when the beaver sees that he may be evicted at any time. He will not go to a great deal of trouble when the landlord may bob up at any moment to evict him or when he lives in a populated area where enemies are around.

Under safer conditions, however, the beaver builds himself a marvellous structure called a "lodge." This is made of sticks, grass and moss woven together and plastered with mud to form a room which may be up to 8ft. diameter and 3ft. high. The "lodge" is usually built on a small island in the lake or dam, with the floor comfortably carpeted with moss, bark, grass and woodchips, a little above the surface of the water. It is provided with two entrances. One is called the "wood entrance" and is used to pass up into the lodge the food to be kept in store for the winter. The other entrance, called the "beaver entrance," is used, as its name implies, by the beavers for entry into the lodge. Both entrances may be many feet in length and are in the form of inclines rising from the water. They are suitably lined and neatly finished off to specifications.

A more remarkable accomplishment of the beaver is the building of dams in order to increase the depth of water around the lodge. This work is accomplished with all the ingenuity used by man himself for the conservation of water.

The simplest form of dam is made from poles and sticks which the animals cut down with their sharp teeth. This is done by gnawing a ring around the base of the tree. The ring is gnawed deeper on the side nearest the water so that the tree will fall in a convenient position for transport. The tree is then cut up into convenient lengths, rolled down to the water and floated into position.

First of all there may be a small earth embankment for the foundations of the dam. On top of this is placed the logs, which may be held in position by upright sticks stuck into the bottom of the dam. The logs are arranged so that the height of the water will be just right and provision is made for surplus water to flow between the logs.

Often the beavers will use stones and mud to reinforce the dam. The stones are carried by the forepaws of the animal, pressing the stone against his chest. It is noteworthy that due regard is paid to the direction of flow of the water, and the curvature of the dam is adjusted accordingly. The water level is kept constant by adjusting the size of the outlet.

BIG DAMS

The dimensions of some of these dams are very great and one adventurer discovered one over 1500 feet long. Often a series of dams are constructed at different levels to maintain the level of water at the main site.

Beavers are bark eaters, and most dams are constructed in a position where timber grows right down to

ARE MATCHED IN ANIMAL KINGDOM

the water's edge convenient for working.

After a period of years the timber supply may become exhausted and the beaver must do something about it. What does he do? Why, just what we humans would do. He builds a canal to a new source of supply. These canals may be hundreds of feet long, 3ft. deep and 3ft. wide.

Sometimes the ground rises too steeply and a continuous canal is not possible. What does Mr. Beaver do? Why, just what we humans do. He builds a lock or a series of locks each at a different level. Beavers have been known to make a short cut across a piece of ground enclosed by a loop in a river by digging a canal. Can we beat him at his game considering he is an animal? He seems to have all the mod. cons. he requires except atom-bombs.

INDUSTRIOUS (?) ANT

Much has been written about the industrious ant. We all know a lot about these insects and some of us far too much from experience of a bite from a bull ant or the flavor imparted to a pot of jam by the millions of the little black pests that come through a crack in the wall to invade our larders. These pests are credited with a certain amount of intelligence. In their constructional work they certainly exhibit remarkable qualities, but it was an article by Mark Twain which, to me, gave the show away and exposed this insect as nothing but a "dumb bell."

As Twain pointed out, if you watch the ANTics of an ant (my pun, not Twain's), you will see him lugging useless rubbish four or five times his size all over the place, anywhere but the right direction for home. He drags this backwards over stones and weeds instead of going round. He rushes madly over gutters which in relation to his size would be equivalent to a man jumping over a precipice carrying a horse in his teeth. Another ant gets at the other end of the bit of rubbish and "helps" by pulling in the opposite direction. This ends in a brawl, after which the first ant forgets that he ever had a piece of junk and rushes madly in another direction, minus a leg or two, searching for more junk. If you watch an ant closely you will see that this is about all he seems to do the whole day long.

UNDERGROUND WORK

In the construction of his home, however, there appears a different story, for here we find an orderly construction of passages and galleries. Some ants, of course, only live under stones, but others weave a silken nest hanging from trees. There is a type known as "Formica Rufa" which builds a nest with a thatched roof, lattice shutters and doors which are closed at night—a real colonial bungalow. In hot climates some ants build roads and tunnels with covered ways for more convenient and comfortable transport and transit while "mad dogs and Englishmen go out in the midday sun."

Our honeymakers, the bees, are so common that many have overlooked the wonderful work that goes on in a beehive, and therefore these insects' methods deserve more than a little mention. The wax comb in a beehive is a work of great precision and has been a subject of great controversy regarding the mathematical details. It is not intended to trouble with these here.

There are two sets of worker bees. One of them makes wax and it is to this fellow that we will direct our attention.

First of all, the wax producer has a good feed of honey, and then rests without moving for about 24 hours, suspended by another wax producer from the top of the hive, so that a series of bee festoons is formed. During this 24 hours, wax is being formed by chemical changes in the honey contained in membranous bags in the abdomen of the bee. This wax exudes through the bags in the form of scales.

MAKING THE COMB

When the wax is ready, the bee goes to his allotted space and clears the deck by turning round a few times just like a dog making his bed. A piece of wax is conveye to the mouth and well chewed wit a frothy exudation until it is o working consistency. This is deposited where it is to be fixed, an the bee carries on until all the wa is used up, when its place is take by another. In this way the foundation is laid for the comb and consists of a single line of wax abou one-sixth of an inch high, a 24t thick, and half an inch long.

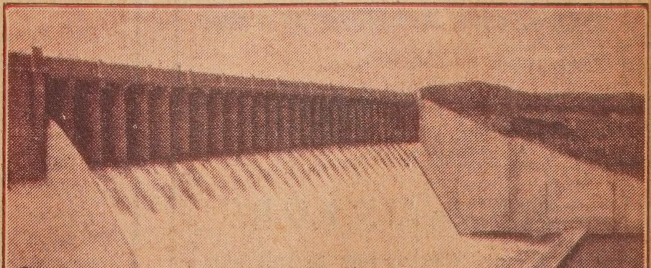
The second type of worker nov comes along and scratches aroun near the middle wall of wax. B manipulation of its mandibles (o jaws, if you like) it forms a cavit to form the base of a cell. Afte a few minutes its place is taken b another, and so on until the hole i deepened and the wall raised to th correct dimensions.

After the first cells have bee built to a certain size, other bee commence work on the opposite sid of the wall with the foundations o two cells.

This work is carried on until th bases of the first cells are formed They are then polished and othe bees commence the second row Meanwhile, the wax producer bee have been laying more and mor wax for the builders to work with The walls of the cells are built i the same way and finally the com is ready for filling with honey.

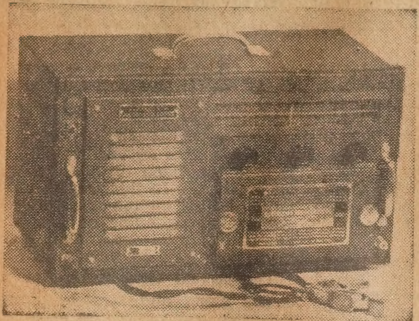
The comb consists of a double rov of cells at right angles to the comb Each cell is a six-sided prism wit its apex lying internally in a depres-

(Continued on Page 53)



This man-made dam at the Hume Weir uses different materials, but the idea is the same.

Amazing Release of Amenities



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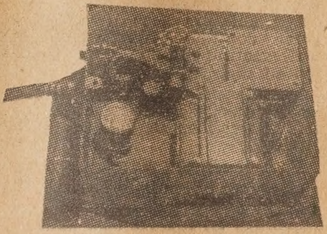

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MAGNETOMETER SEARCHES FOR OIL

IT has long been known that oil is frequently found on geological anticlines (strata folded in the form of an inverted U). The progress of investigations was greatly enhanced by aerial photographic surveys, which provide a detailed base map disclosing important geological conditions.

Where results show generally favorable conditions and a reasonable probability of the existence of oil deposits the geophysicist undertakes detailed investigations of sub-surface conditions.

Geophysical investigations can be carried out by the seismic method, in which a "seismic impulse" is sent vertically downward and its returning echoes picked up and recorded. The interval between the time of the explosion and the arrival of the reflected waves reveals details of sub-surface formations.

THE "BIRD"

Now the airborne magnetometer has been added to the oil prospector's investigation equipment. Known as the "Bird," the magnetometer is trailed behind and below an aircraft and measures the changes in the earth's magnetic field.

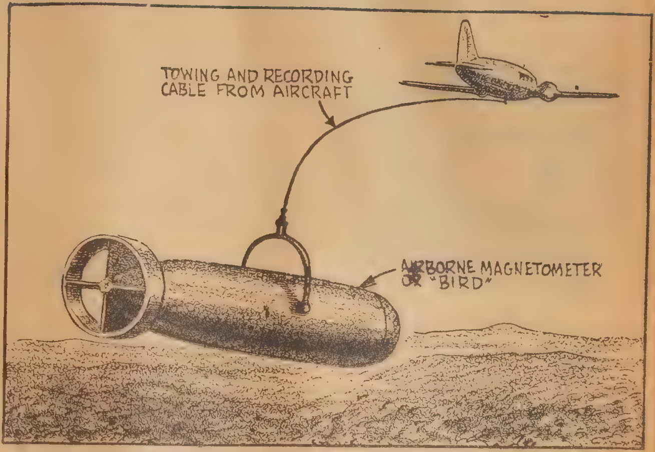
The mechanism is so sensitive that its recordings can be interpreted by the geophysicist as a guide not only to the type of underground formation but an estimate of its depth.

This information is valuable in indicating the likelihood of the presence of oil-bearing structures. It depends on whether the granite igneous base is below a thick layer of sedimentary rocks, or not, as to whether an oil area is worth exploring.

INTERPRETATION

A weak signal from the magnetometer indicates the base is at great depth. If it is 5000ft. or more below the surface there would be ample space for oil reservoirs.

A strong signal indicates that the granite base is close to the surface, so that the overlaying cover of sedimentary rocks must be thin.


TOWING AND RECORDING CABLE FROM AIRCRAFT
AIRBORNE MAGNETOMETER OR "BIRD"

In the search for oil, carefully-laid plans of well-organised groups have replaced earlier hit-or-miss methods, and recently the airborne magnetometer has been added to the instruments at the disposal of the geophysicist in investigating rock formations underground.

Sketches show how the airborne magnetometer is towed, and how the position at which any recording is made is recorded. Over land the readings are synchronised with aerial photographs, and over the sea the aircraft is located by means of Shoran, a radar device developed during the later war years.

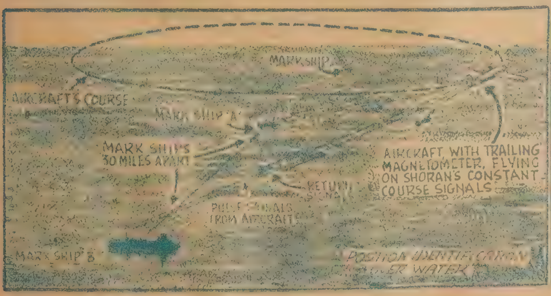
Recently an area of some 50,000 square miles of land and water in the Bahamas (British West Indies) has been investigated by this method.

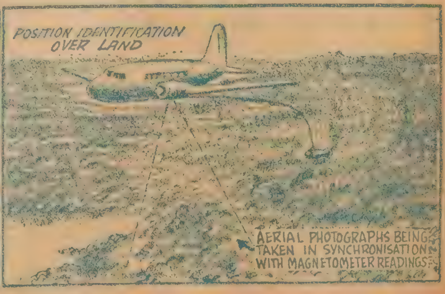
In addition, the gravimeter was also used in the survey. This device measures variations in the earth's gravitational field and provides information about sub-surface structures. Most of the Bahamas area under survey is under comparatively shallow water, and the instrument has to be shipborne, but, as stability is essential for accuracy, it is placed in a submersible chamber and lowered, with a human observer, to the seabed.

MAP DATA

By the use of the gravimeter and the airborne magnetometer it is possible to build up a group of accurate recordings, measured in isograms, from which maps of the region are prepared for use at a later date when actual borings are made.

Many oilfields lying under the ocean bed are being exploited. This has been made possible by the perfection of directional drilling methods. On the ocean front in California, Louisiana and Texas, where oilfields extend for thousands of feet under the water, wells go down and out under the ocean's bed.


MARK SHIP
AIRCRAFT'S COURSE
MARK SHIP 'A'
MARK SHIPS 30 MILES APART
RETURN SIGNAL
PULSE SIGNALS FROM AIRCRAFT
AIRCRAFT WITH TRAILING MAGNETOMETER, FLYING ON SHORAN'S CONSTANT COURSE SIGNALS
MARK SHIP 'B'
POSITION IDENTIFICATION OVER WATER


POSITION IDENTIFICATION OVER LAND
AERIAL PHOTOGRAPHS BEING TAKEN IN SYNCHRONISATION WITH MAGNETOMETER READINGS

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FEATURES:

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- ★ TUBE AND RESISTOR CAPACITY NETWORK ARE BUILT INTO THE DETECTOR PROBE.
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4v at 3 amp
42/6
(Freight Extra)

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5000ohm	10/1
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150v at 30mA. 6.3v at 2 amp.
22/6.

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The 240v AC. Midget 4-Valve Kit-completely assembled, Ready-to-Wire—Ultra Modern Cabinet. Hi-gain valves, etc. A winner. Freight Extra £13/7/6

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Midget 150v 30m P/Trans.	24/6
Midget Minimax 67½v.	17/1
Midget Cedar Cabinets	17/6
Flush push on knobs	1/3

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1L4	23/4	7A8	19/3
		7C7	17/5
1R5	20/6	7D7	17/3
1S4	20/6	7W7	17/3
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Browns 2000ohm. Brand new .. .. ..27/6 pr.

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6v-220v-Vib. Packs. Fully filtered, etc., in strong steel case. (Cannot be repeated). Weight packed 25lb. Freight Extra) 85/-

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Highly-polished metal probes, with poly tip takes button type tube. Ideal for vtm's sig-tracers, etc. 8/6

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NEWS AND VIEWS OF THE MONTH

Sir Ernest Talks

AT a well-attended meeting of the Brief Club in Sydney recently, we had the pleasure of listening to Sir Ernest Fisk, now managing director of EMI in England.

Sir Ernest, who was formerly managing director of AWA, is the executive head of the Empire's biggest electronic and musical company, which, incidentally, owns the group of British record manufacturers and controls the EMI television system as used by the BBC.

Sir Ernest commenced his talk by taking firm but good-humored exception to his Press description as "the man who had come to Australia on a bicycle to sell television." This was not the case at all, he protested.

But for a man who had just disowned himself as a television salesman, he proceeded to give as fine and enthusiastic a pep-talk on the subject as we have ever heard.

BEST BET

Not that we can blame him, for Australia, with the possible exception of Canada, is probably the best television bet within the Empire. Any managing director with such powerful television backing who went back to England without having done everything possible to sew up the EMI system for Australia, if and when it comes, would just not be doing a job.

His audience was quite definitely pleased to hear and meet again a man whose ability and drive have brought distinction to himself and to Australia (although actually Sir Ernest was born in England), but they were perhaps a trifle disappointed to hear so much enthusiastic material about television without any ideas which would help greatly in our planning to make it a reality.

We all know now that black and white television presents no technical problems, although it is still a complicated business using accepted technique. As far as the public is concerned, it has more to offer than FM, which, after all, is just another way of doing something we have had for many years. What we all want to know is how to go about establishing a service which can be paid for, both at the transmitting and the receiving end, and how to guarantee that programme material will be available which will sustain interest and keep the thing together. Our local resources may not be able to produce these resources, apart from newsreels which undoubtedly will have a big pull. Moderately priced English and American sets might attract buyers in exchange for four hours' programme per day, but ou sets are going to cost plenty of money for such entertainment.

Another point to remember her is that Australians are very largely outdoor people. They can take thei radios with them to the beach and in their cars. Can they do likewise with television? Let us face the fac that they will expect a good deal fo their money when they do buy a set and, at the moment, it is hard to see that the return will be there.

REALISM v. ROMANTICISM

As was pointed out by Mr. Kennell who thanked Sir Ernest for his talk this isn't pessimism, it is merely being realistic. We have already seen how rosy promises can upset trade stability in the case of FM. No modern thinking engineer or broadcaster wants to block television or any other forward move. He just doesn't want to go broke by unwise handling of it.

If we can't altogether agree with Sir Ernest that television will become one of the world's biggest industries—bigger than radio—we don't need persuasion that it's a good thing.

RADIO CROSSWORD PUZZLE No. 7

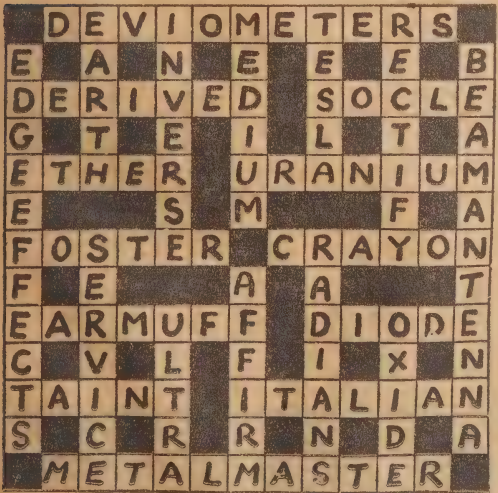
ACROSS.

1. For hearing.
3. Combining form: without life.
7. Electroscopes.
9. Vibration sideways.
10. Unit of elastance.
11. Freely used in wireless.
13. Meter ends.
17. Arm.
18. Type of coil.
20. Type of Radar signal.
21. Reduction.
22. Units of work.

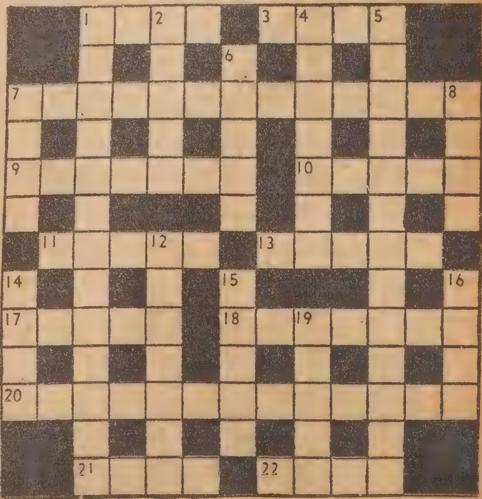
DOWN.

1. Obsolete term for electricity. (2 words).
2. Movable part.
4. Voltage divider.
5. Type of antennas (2 words).
6. Inductances.
7. Measurement units .
8. Valves have little use when . .
12. Magnetic.
14. Title of nobility.
15. Momentary discharge.
16. Radios.
19. More pleasing.

BELOW: LAST MONTH'S SOLUTION



■	D	E	V	I	O	M	E	T	E	R	S	■
E	■	A	■	N	■	E	■	E	■	E	■	B
D	E	R	I	V	E	D	■	S	O	C	L	E
G	■	T	■	E	■	I	■	L	■	T	■	A
E	T	H	E	R	■	U	R	A	N	I	U	M
E	■	■	■	S	■	M	■	■	■	F	■	A
F	O	S	T	E	R	■	C	R	A	Y	O	N
F	■	E	■	■	■	A	■	A	■	■	■	T
E	A	R	M	U	F	F	■	D	I	O	D	E
C	■	V	■	L	■	F	■	I	■	X	■	N
T	A	I	N	T	■	I	T	A	L	I	A	N
S	■	C	■	R	■	R	■	N	■	D	■	A
■	M	E	T	A	L	M	A	S	T	E	R	■



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The York Features:—

Attractive Bakelite Cabinet (as illustrated); size $10\frac{3}{4}''$ x $6\frac{3}{4}''$ x $6\frac{1}{2}''$.

Rola 5 inch speaker. R.C.S. Intermediates.

Valves, 6J8G, 6G8G; 6V6GT, 6X5GT.

Full Vision Dial.

Complete to the last nut and bolt, including valves

A proved circuit with full instructions, easy to follow.

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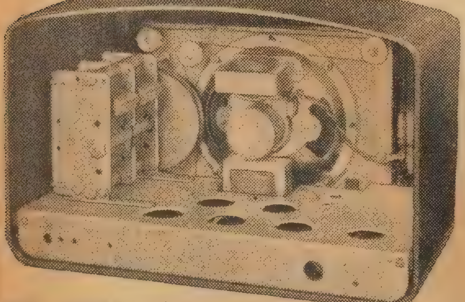
Or ALTERNATIVELY, may we suggest !!

"The YORK" FOUNDATION KIT

A boon to the small manufacturer



"THE YORK" Foundation Kit as it reaches you, packed in stout carton, with circuit and full instructions.

Comprising:—

Cabinet (as above); Chassis; Dial Assembly and Scale; Special AER-Osc Coil; Rola 5C Speaker Rola 6/60 Choke; S/Carlson 2-Gang H. Condenser; Circuit Diagram. Complete Parts List. Simple step-by-step Instructions, "How to Build It." Price on Application.

Write, phone or call for special price for quantities.

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It may be that, with his intimate knowledge of conditions both in Australia and England, Sir Ernest will not leave us without presenting some very concrete proposals as to how television could be successfully and economically introduced here.

Undoubtedly, however, there will be other interested parties in the television field who will be anxious to do the same thing. As television presupposes a corresponding FM sound broadcasting system, it is most unlikely that any final plans will be made for some time to come. In this regard, we can only agree in principle with most that Sir Ernest had to say, while admitting that none of it has given us cause to revise our appraisal of the position made just two years ago.

Television City

The Walter Butler Co., of St. Paul, Minnesota, a contracting firm headed by the US Ambassador to Australia (Mr. Robert Butler), has announced a £15,540,000 "television city" project on the Chicago lakefront. The company which operates large mining interests will build a 35-story television station with a sports palace—an indoor stadium seating 55,000 people and an outdoor stadium seating 70,000. In Australia——?

Atomic Energy

Victorian alpine streams are being searched for atomic energy materials. Victoria, Queensland, Western Australia and Tasmania have been granted financial help by the Commonwealth for preliminary surveys of areas believed to contain atomic energy mineral resources. This is part of the Commonwealth plans for atomic energy development in Australia.

The Council for Scientific and Industrial Research has begun a programme of research into the minerals. NSW and SA are not being assisted because they have already learned a good deal about local resources.

Australian Music

ONCE again, we are hearing the complaint that recorded music is keeping Australian performers and composers off the air. Suggestions have been made that large sections of broadcasting time should be by regulation devoted to local live-artist performances, particularly by B-class stations.

We agree that there is much deplorable imported rubbish broadcast at present. But our serious musicians should remember that the gramophone record has shown us what standards can be reached. They must be prepared to meet this competition, rather than, by legislation, force us to hear poor quality performances in the mistaken idea that thereby Australian music will benefit.

We have very few really good performers in Australia, and only half a dozen good compositions. Let us be realistic about this, otherwise we will be in danger of building up protection for the mediocre, to which people will not wish to listen.

TECHNICALLY in the know

TO-DAY more than ever before, it is essential to keep fully informed on electronic matters.

RADIOTRON offers a technical service on valve applications that is unique in the radio world.

RADIOTRON TECHNICAL PUBLICATIONS INCLUDE:

I. "Radiotronics"—quarto size—20 pages per issue—sections devoted to DESIGN, THEORY, CIRCUITS and VALVE DATA—published every other month.
Handy filing covers are supplied with available back issues to "Radiotronics" subscribers.

II. Data Book—octavo size—150 sheets in loose leaf binder—comprehensive data on all Australian-made receiving types—new and revised sheets released periodically.

III. Valve Charts—quarto size 36 pages covering characteristics, classification tables, socket connections—special section on Australian-made types—comprehensive substitution directory.

plus first-hand knowledge on power valves and allied types, cathode ray tubes, the miniature range, circuits and associated components, as released. This information is just another service offered you by Radiotron.

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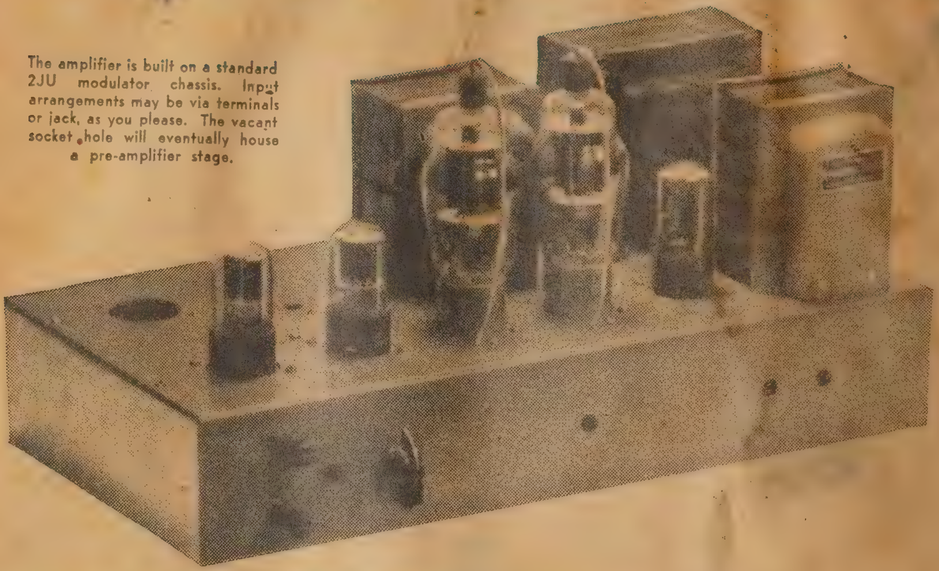
TRIODE-CONNECTED 807 AMPLIFIER



The amplifier is built on a standard 2JU modulator chassis. Input arrangements may be via terminals or jack, as you please. The vacant socket hole will eventually house a pre-amplifier stage.

This amplifier is so good that more than once we began double-checking results to make sure we weren't mistaken. Its frequency response so flat up to 35 kc that it can only be represented by a straight line. total harmonic distortion is below .1 per cent. at 11 watts and very e more at 17 watts. Its gain is sufficient for use with medium to h output pickups, and almost any type of radio tuner. Truly, an amplifier to end amplifiers!

YOU will remember that in our January issue, we were able to publish an article reprinted from "Radiotronics" describing an amplifier very similar to that described here.

This amplifier was based on a design first published in the English journal "Wireless World," well known for its sponsorship of many fine and original developments in radio.

The design attracted a great deal of attention, and our own interest in it was apparently shared by many other people, including the engineers of the A. W. Valve Co.

AUSTRALIAN VALVES

The original amplifier, of course, was designed for use with European type valves, not easily obtainable here, but for which we possess almost duplicate types.

The Radiotronics circuit was evolved in an attempt to use the original ideas as applied to valves which you can buy, allowing of course for the inevitable temporary shortages from time to time!

By reference to Radiotronics article, you will see that the results were unbelievably good, and substantially the same as those obtained by Wireless World.

It is not hard today to build amplifiers which have very flat frequency characteristics. What makes this job so much better is its low percentage of harmonic distortion—so low that we can consider it for our purposes as being non-existent. It is far and away superior to comparable characteristics which can be quoted in reference to pick-ups and loudspeakers with which it will be used.

ANY of the tuners described to date may be used with this amplifier, providing a suitable dropping resistor is used to reduce the tuner high tension to 250 volts. A spare filament winding is specified. We will be describing other tuners soon.

The advantages of such an amplifier are obvious. It means that when assessing performance, we can virtually eliminate the amplifier from our calculations, as it is near perfection as a device to faithfully amplify any audio voltages we are likely to feed into it.

In actual practice, it sounds just that way. It has a clean, crisp character about it which can only be obtained by providing adequate reserve output without distortion of any kind.

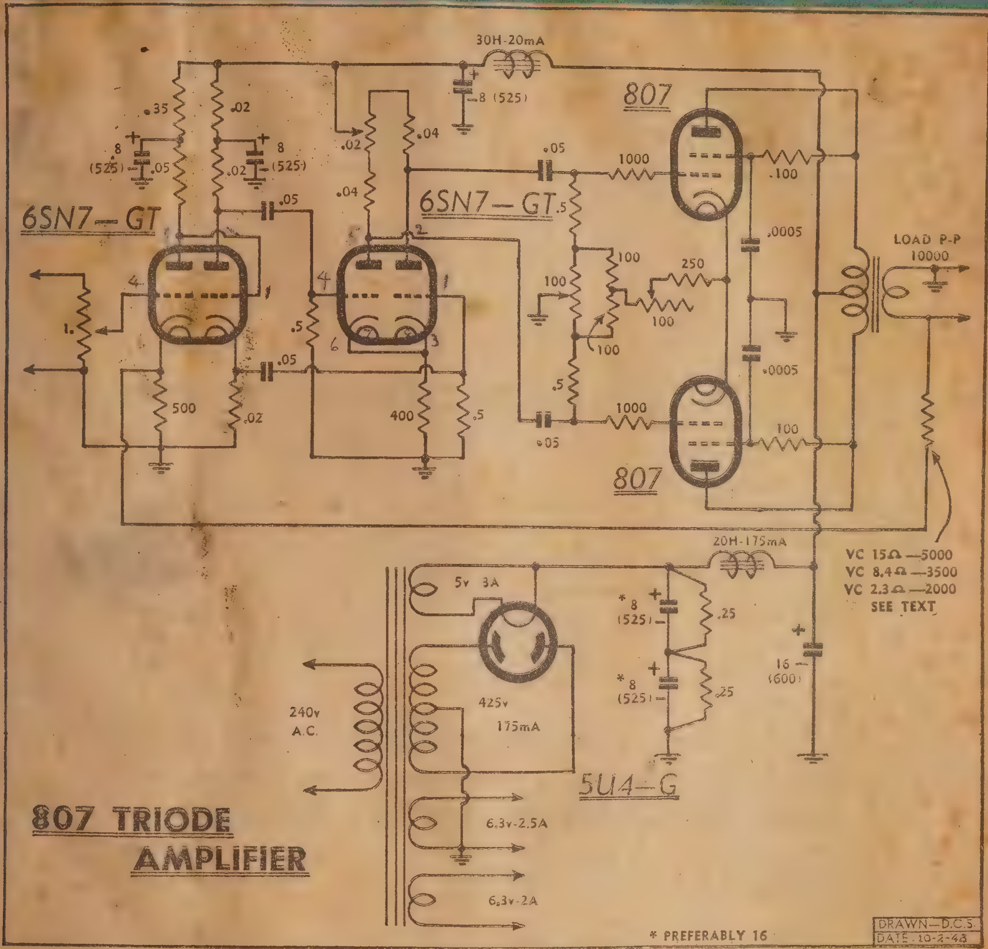
How does it compare with the amplifiers using 807 "pentodes" with feedback, we have been describing of late? That is a question many of our readers have already asked.

A "BEST" AMPLIFIER

Volume for volume, it is definitely better. The better your input and output arrangements are, the better it will sound. But if you use the average type of pickup and speaker, we don't suggest you scrap many hours of work put into one of our previous amplifiers expecting to be stunned by the improvement. Because it will be the limitations of pickups and speakers which will in effect limit your results with any of our recent jobs.

At the same time, if you intend to build a new amplifier from the ground up, would do well to consider this new design. If a maximum output of about 15 watts will suit you, and generally it will, your results will be better than with previous types. It will not have such a high over-all gain, and a pre-amplifier will be needed for pickups having a low output. We intend to do

CIRCUIT DIAGRAM OF THE 807 TRIODE AMPLIFIER


30H-20mA
807
8 (525)
.35
.02
8 (525)
.05
.02
8 (525)
.02
.04
.04
.05
.05
1000
100
6SN7—GT
6SN7—GT
.5
.0005
LOAD P-P
10000
100
250
100
100
100
1.
4
1
4
1
2
.5
6
3
.05
500
.02
400
.5
.5
1000
.05
100
.0005
807
20H-175mA
VC 15Ω—5000
VC 8.4Ω—3500
VC 2.3Ω—2000
SEE TEXT
5v 3A
*8 (525)
.25
*8 (525)
.25
16 (600)
240v A.C.
425v
175mA
5U4—G
6.3v-2.5A
6.3v-2A
807 TRIODE AMPLIFIER
* PREFERABLY 16
DRAWN—D.C.S.
DATE 10-2-48

The circuit is particularly simple, consisting merely of a resistor condenser network. The feedback resistor valve is not highly critical, and results are nearly as good with no feedback at all.

some work along these lines with the idea of bumping up the gain without affecting present performance. But for the average crystal and magnetic pick-up, and the average 12 inch speaker, you will have enough gain to get plenty of sound.

Having more or less put the amplifier in its place in the scheme of things, we can proceed to tell you more about it.

Briefly, it consists of an output stage using a pair of 807's wired as class A triodes. In this connection, the plates and screen of each valve are connected together, a screen suppressor of 100 ohms being included, and a voltage of 400 used.

The valve manufacturers are carrying out life tests to see whether there are any undesirable effects due to operating the screen at this higher-than-usual voltage. There do not appear to be any, however, and no dissipation ratings are exceeded.

Ahead of the output stage is a pair of push-pull drivers, in the shape of a 6SN7 dual-triode, resistance coupled to the 807's.

INPUT STAGE

The input stage is another 6SN7, the first section being a voltage amplifier direct coupled to the second, which is a normal phase-splitter to drive the push-pull driver stage.

Degeneration is freely used throughout the amplifier. None of the bias resistors is bypassed, a practice which, although lowering the overall gain, reduces the harmonic distortion to a very low level.

A further feedback provision is made by bringing back into the cathode circuit of the first stage suitably phased voltage from the loudspeaker voice coil.

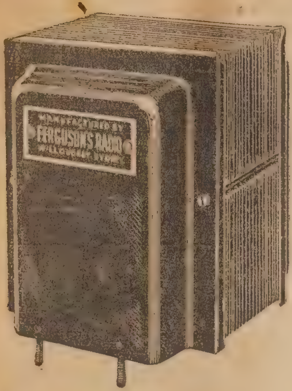
With an amplifier of this quality, the effectiveness of this feedback loop depends largely on the quality of the output transformer, as pointed out last month. For this reason, several manufacturers have made special transformers for the circuit. Two we have tested so far are the Ferguson, and the Swales and Swann, both of which are of exceedingly high quality.

Don't think that the circuit will not operate at all using ordinary output transformers. It will, but the extreme freedom from distortion which characterises the circuit will

5160

LATEST

TRANSFORMER DEVELOPMENT



We have made available for general release three components ideally suitable for the "High Fidelity Amplifier" in this issue. These include a Hi-Fidelity output transformer and two filter chokes.

Output Transformer Type OP25*

Primary Impedance .. .. 10,000 P-P.
Secondary Impedance .. 8.4 ohms & 2.1 ohms, or any 4/1 ratio of secondary impedance e.g. 500 ohms & 125 ohms.
Frequency Response .. .. .. ± 0.5 db 20 c/s to 30,000 c/s.
Primary Inductance .. .. .. 110 henries at 5V A.C. 50 c/s.
Leakage Inductance .. .. 14 millihenries
Insertion Loss .. .. 0.3db. at 1000 c/s.
Finish .. .. Grey Brocade
Mounting .. .. Vertical
Weight .. .. 6½ lbs.

*** Add Secondary Impedance After Type No. : OP25—8.4/2.1**

FILTER CHOKE TYPE C12/200

Inductance .. .. 12 henries
D.C. Resistance .. .. 150 ohms.
Mounting .. .. Vertical
Max. D.C. Current .. 200 ma's.
Finish .. .. Grey Brocade
Weight .. .. 6 lbs.

FILTER CHOKE TYPE C30/25

Inductance .. .. 30 henries
D.C. Resistance .. .. 1000 ohms.
Mounting .. .. Bracket (Vertical)
Max. D.C. Current .. 25 ma's.
Finish .. .. Grey
Weight .. .. 1 lb.

LABORATORY SERVICE TO MANUFACTURERS

The Ferguson Laboratory is continually engaged in research for the improvement and advancement in the transformer and electronic field. This Laboratory together with its technical staff is available to assist manufacturers with their transformer problems.

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STH. AUST.: APEX AGENCIES.

not be attained to the same degree. Inspection of our circuit will show that we have modified the Radiotronics version in a few minor details.

The first point to note is the lower transformer voltage we have specified. This is made possible by the use of condenser input instead of choke input. Choke input will allow slightly better regulation at the extreme limits of output, which, being about 17 watts, the average man isn't likely to require. As a result, our amplifier might have a maximum output slightly lower than this. A very small point, as few will ever use it over about 10 watts.

The absence of the second filter choke has no appreciable effect on hum level. Particularly if you use 16 mfds. filter condensers throughout, you will be hard put to it to notice any hum at all.

POWER SUPPLY

We have also included in our specifications an extra filament winding for use when and if a tuner is used. For the same reason, we have specified a secondary winding which will accommodate such a tuner. If you bring the necessary leads out to a socket at the rear of the chassis, you will have a handy point of connection. The voice coil leads are connected to a pair of terminals at some convenient spot.

The voltage from the power supply is much too high for a tuner. A series resistor must therefore be used to reduce it to approximately 250 volts. We found a suitable wire-wound resistor of 7000 ohms was OK for a three-valve tuner.

The circuit provides for adjustments to balance the drive to the 807's, and also the individual plate currents of these two valves. It would be possible to do without them, but their addition is such a simple matter that we strongly advise you to include them.

The adjustment of the 807 circuit is two-fold. There is a variable 100 ohm resistor, in series with one of 250 ohms, the function of which is to vary the grid bias until the plate current of the valves is 140 mills for the two.

807 BALANCE

The second resistor of 100 ohms allows the plate current of the 807's to be balanced, so that each draws 70 mills. Both these adjustments are made quite simply by the insertion of a DC milliameter of suitable range firstly in the common cathode circuit return, and secondly in the cathode return for each valve.

Balancing the input to each 807 isn't quite as simple, as the only obvious instruments likely to be satisfactory are the CRO or a VT voltmeter, with which to measure the grid voltages supplied to each output valve in turn. The degree of unbalance is likely to be about 10 per cent., or slightly more in extreme cases. This would show up only in a slight reduction in output without distortion, and if the amplifier is not required for high outputs, it may not be so important. However, this is something in the nature of a special amplifier, and to be even more exact, the method described in last month's article for balancing output voltages of the 807's instead of input voltages would be best of all. For practical purposes, balancing the grid circuit will be quite OK.

OPTIONAL POT

The adjustment for bringing about this balance is the 20,000 ohms potentiometer in the plate circuits of the push-pull driver stage. There should be sufficient variation in this control to achieve balance in any normal 6SN7.

We mounted our potentiometer below the chassis on a bracket, immediately below a small hole, through which adjustment coud be made with a screwdriver. The shaft was a short one, fitted with a screwdriver slot.

If you cannot conveniently make this adjustment for the time being, by all means go ahead, omitting the potentiometer altogether. As we have said, in most cases, the difference in results will be very small.

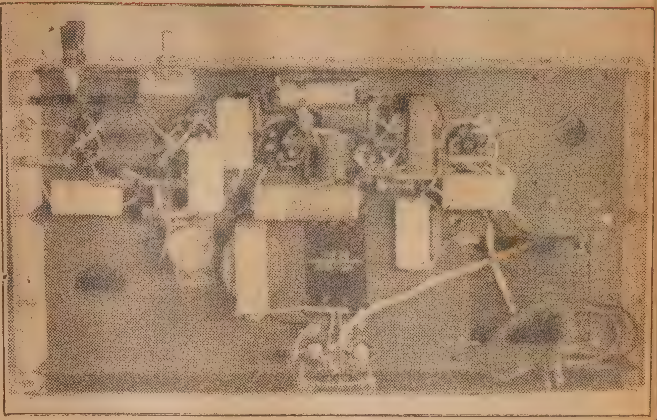
As 6SN7 valves may not be as easy to obtain as one would wish, they can be replaced by a pair of 6J5 valves in each case, without alteration to the circuit or values. This necessity would affect layout, of course, but even if the chassis design were to vary considerably from the one we have used, results are unlikely to be prejudiced unless you do something very silly!

Building the amplifier should present no difficulties. We found that most of the components could be supported from the valve sockets themselves, with the aid of a few strategically placed insulated mounting lugs.

CONTROL POSITION

The place of the volume control and input terminals isn't symmetrical along the front of the chassis, but we don't like making leads to and from these things too long. If it is essential, the volume control can be placed centrally, with shielded connections, and an input jack can of course be used in place of input terminals.

THE AMPLIFIER FROM BENEATH



The wiring is merely a matter of neat assembly and reasonably short leads.

PARTS LIST

AMPLIFIER—

1 2JU Modulator chassis.

1 Power Transformer, 425-0-425v at 175 mA, 6.3v, 2.5a, 6.3v, 2.5a, 5v 2a.

1 Special Output transformer, 10,000 ohm, CT to 2.1 or 8.4 ohm vc—see best.

1 Choke, 20 henries, 175 mA; 1 Choke 30 henries, 20 mA.

VALVES:

2 807's, 2 6SN7-GTs, 1 5U4-G.

CONDENSERS:

3 8 or 16 mfd, 600 PV, 1 16 mfd, 600 PV, 2 8 mfd, 525 PV, 4 0.05 mfd, 600v wkg.

RESISTORS:

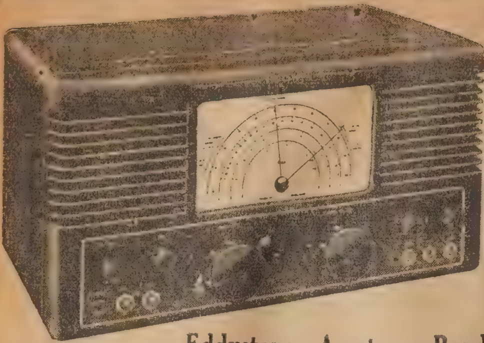
2 100 ohm, 1 400 ohm, 1 500 ohm, 1 250 ohm, 2 1000 ohm, 1 5000 ohm, 3 20,000 ohm, 1 35,000 ohm, 2 40,000 ohm, 1 50,000 ohm, 2 .25 meg, 4 .5 meg, wire-wound—2 100 ohm, 2 100 ohm with top.

POTENTIOMETERS:

2 100 ohm, 1 1.0 meg, 1 20,000 ohm.

SUNDRIES:

2 terminals, solder lugs, hook-up wire, nuts and bolts, power flex.



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Eddystone Amateur Bands Communications Receiver Model 640

MAIN TECHNICAL FEATURES

1. Receiver has been designed primarily for Amateur Communication purposes, tuning range from 31 Mc/s to 1.7 Mc/s.
2. Designed to operate from Standard AC Mains with Inputs of 110 volts, 200/240 volts, 40/60 cycles, as well as from a 6 volt Battery by the use of a separate vibrator unit.
3. Inclusive all valves, the "640" is a 9-valve job with one tuned RF stage, FC, two IF stages, detector-AVC-1st audio, 2nd audio output, noise limiter, BFO and rectifier. The valves used, in that order are EF39, 6K8, EF39, EF39, 6Q7, 6V6, EB34, EF39 and 6X5. These are all international octal based on the Mullard or Brimar versions and are therefore easily replaceable.
4. INPUT IMPEDANCE—400 ohms.
5. TUNING RANGE—
   (1) 31 to 12.5 Mc/s.
   (2) 12.5 to 5 Mc/s.
   (3) 5 to 1.7 Mc/s.
6. TUNING. An electrical band-spread arrangement is used for this purpose. Fly-wheel control is utilised on the band-spread condenser drive. The scale is clearly marked with all amateur bands, and is so arranged to enable accurate re-setting to a spot frequency.
7. I.F. FREQUENCY—1600 Kc/s.
8. CRYSTAL FILTER is vacuum mounted to provide a high degree of stability. Phasing control and "in/out" switch are brought out to the front panel.
9. Sensitivity is better than 2 microvolts input, for 50 milliwatts output, at all frequencies.
10. OUTPUT. Audio frequency output exceeds 3.5 watts.
11. "S" METER. A socket is provided for an external "S" Meter.

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- WEST AUSTRALIA: CARLILE & CO., Hay St., Perth, and 397 Hannan St., Kalgoorlie.
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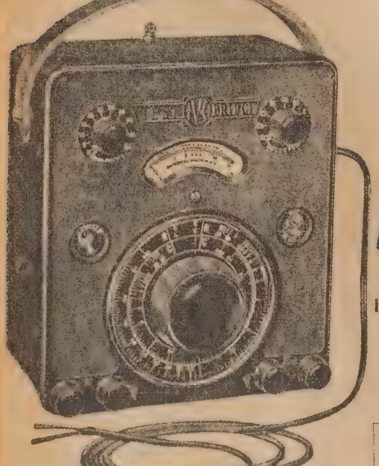

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One reason we placed the control where it is was because of our intention to add an extra stage as a pre-amplifier. We have been making some experiments with low-output type pick-ups, and particularly with bass compensation circuits, we find extra gain necessary for full amplifier output. We may have something to say about such pre-amplifiers in the near future. But they will be additions to the present basic circuit, and we do not anticipate any alterations to the amplifier as a whole.

Talking of gain, the use of feedback from the voice coil reduced the gain by an appreciable amount. If you find that for any reason your pick-up is a bit lacking in output, removal of the feedback will, in all probability, not be noticed in your results, except possibly with the very best of equipment. Feedback in this circuit is not nearly as important as it would be, were the valves to operate in pentode connection, for obvious reasons. It is just one more precaution which can be taken to ensure that the extremely good output characteristics will be obtained.

FEEDBACK

To remove the feedback, it is merely necessary to omit the feedback coupling resistor from the voice coil circuit. It is interesting to note how the inclusion or otherwise of this resistor affects results.

This feedback resistor will require selection according to the voice coil impedance of the particular speaker you use. That is why we have shown alternative values on the circuit diagram.

It is obvious, of course, that with the high impedance voice coil, more voltage will be available than from a low impedance coil. Thus, in the latter case, it is necessary to reduce the value of the feedback resistor for these lower voice coil impedances.

The value of resistor given in the Radiotronic circuit is not very useful because it is operating from a 15-ohm output, and very few speakers in Australia have voice coils as high as this. The Rola K12 has a 2.3-ohm voice coil, the G12 and Amplion 12in. speakers about 8 ohms. Some others have 12 ohms.

Our circuit diagram shows values for use with these impedances, and which will give feedback values almost exactly the same as in the original design.

RESISTOR VALUE

We would point out once again that very little effect will be noticed by using a much lower degree of feedback than provided for—in fact, as we have said, it can even be removed altogether and still leave an amplifier better than the average.

It is not important, therefore, that the feedback resistor be of an exact value—should you have a speaker with a voice coil impedance differing from those shown, it will be sufficient, having first obtained a transformer which gives a good match, to estimate a resistor value from those given. It is much better to err on the large than the small side. Our values have been calculated and measured to give about 20 d.b. reduction in gain. This is just about the limit one can realise without a tendency to oscillation at the lower frequencies, and, therefore, it should not be exceeded.

Without feedback, output is about 7½ watts, increasing to over 11 watts with feedback. This is for completely clean output, but with feedback, 17 watts may be reached with little distortion. To obtain these latter figures, feedback is necessary.

RIGHT SIDE

Incidentally, it is important to connect the feedback resistor to the right side of the voice coil winding. If you get it the wrong way round, violent oscillation can be expected, as the feedback will be positive rather than negative.

These output figures line up almost exactly with those obtained from the original Radiotronics amplifier.

Concerning distortion, we made a number of measurements across a resistive -loaded voice coil both for power output and frequency response. At the present time we cannot make direct measurements of harmonic distortion, but there is no reason to think that our amplifier would be very different from the original design.

Without the bypass condensers on the screen of the 807 valves, the frequency response was quite flat from 20 cycles to more than 50,000 cycles, with a measurement of 5 volts across an 8.4-ohm voice coil winding—an output of 3 watts.

RESPONSE

With the bypass condensers, output was flat from 20 to 20,000 cycles. At 50,000 cycles it had dropped to 4.3 volts, and it was still 2.5 volts at 80,000 cycles, with a slight peak to 5.5 volts at 60,000 cycles.

If you work that out in decibels, you will see just how good the amplifier is. For audio work, it can be regarded as being virtually flat and distortionless.

Our power output checks were taken at 1000 cycles.

It isn't very much use using the amplifier except with large speakers properly baffled. This restricts it virtually to the 12in. types, with the K12 type as being a reasonable compromise. If full output is required, some of the larger heavy-duty speakers occasionally obtainable should be used.

Although flat baffles are widely used because of their simplicity, we strongly advise a better method of loading, such as the use of a vented enclosure. This device reduces speaker distortion by quite a bit, raises speaker efficiency, and by elimination of the back radiation as such, greatly simplifies the problem of making use of the output. It is unwise to feed too much input to any speaker without good loading. With the use of an exponential horn, even an 8in. speaker could probably be used with good results

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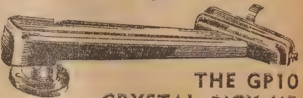

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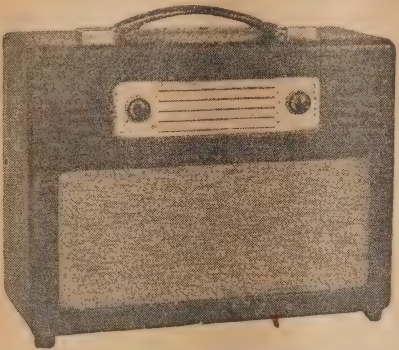

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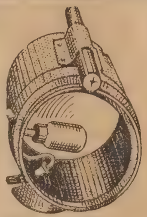

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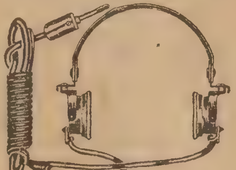

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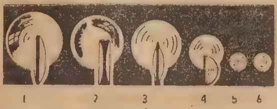

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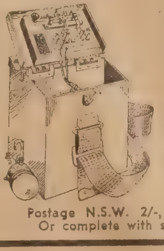

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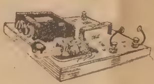

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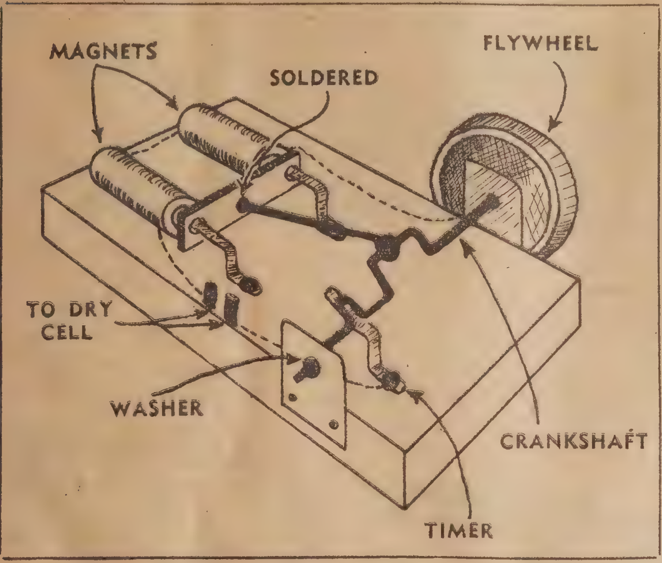
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

As a change from radio circuits, here is a little reciprocating engine which can be made to run from a dry cell. All you need to build it is a few scraps of wire and brass and a pair of magnets from an electric bell.



OPERATED on a dry cell, this engine runs at a fast clip. Two electro-magnets taken from a doorbell provide the pulling power to operate the "piston" which is a piece of heavy gauge sheet iron, soldered to a connecting rod, and drilled to slide on two pieces of heavy wire. Two ends of the wires are bent and screwed to the base, and the other ends are inserted into shallow holes drilled into the cores of the magnets.

The connecting rod and crankshaft are made of heavy wire and the crankshaft has two throws, one for the connecting rod and one for the timer which is a strip of copper. The flywheel is made of wood or metal and the crank assembly is supported by two metal brackets which serve as bearings. The assembly is held in place by the flywheel on one side and a small washer soldered to the crankshaft on the other.

In setting the time, it should be in contact with the crankshaft from the beginning of a stroke towards the magnet until just before the piston reaches the end of the stroke next to the magnets. In operation the current flows through the magnets to the bearing next to the flywheel, then through the crankshaft to the timer and back to the dry cell.—J. O'Brien, Victoria-street, Cardwell, NQ.

TREATING MASONITE

WHEN masonite becomes old or weathered it sometimes tends to lose its new lustre and takes on a dry powdered appearance. However, it can be treated quite simply so that it will regain its original finish.

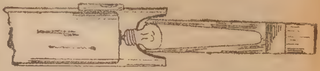
The masonite is painted with brown, or chocolate, enamel and left for an hour or so, until the paint soaks in. The surplus paint is then removed and the masonite polished with a rag. The surface must be perfectly smooth as any little scratch will show up. Any small holes can be filled with a thick mixture of powdered masonite and paste, or glue, which is forced in, smoothed off and allowed to dry. The original texture of the masonite remains and a high polish is given to it.

(From M. F. Currey, Post Office, Coramba, NSW).

HANDY HINTS

CLOTHES PEG

THE reflector in some small torches is so shaped that it is difficult to remove with the fingers a globe which has been screwed too firmly in place. Get an ordinary wooden clothes peg, narrow the ends slightly, if necessary, and use it to grip and unscrew the globe. (From V. K. Turner, Qld.).

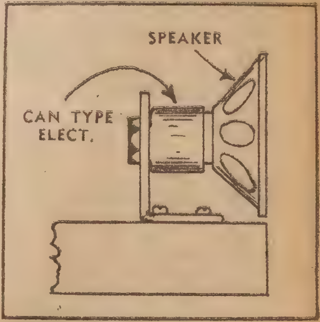


SPEAKER MOUNTING

SOME of the new permag. speakers have no mounting brackets and set builders often fix them to the chassis by rather makeshift methods.

If the magnet of your speaker is a little less than 1½in. in diameter and you have on hand any of the old-type, broken-down wet electrolytic condensers, which are 1½in. in diameter, cut one through with a hack saw at a point about 1in. distant from the positive or nut end and this will then slip right on over the magnet.

As the diameter of the magnet on the speaker is slightly less than the inside diameter of the electrolytic condenser, wind a few turns of rubber insulating tape round the magnet. In addition to acting as packing, this prevents chattering when the speaker is in action



If the hole in the chassis is made by boring two holes ¾in. apart and filing away the metal between them, the speaker, when mounted, can be moved backward or forward until the speaker rim comes up against the front of the cabinet. (M. C. Wood, Brisbane).

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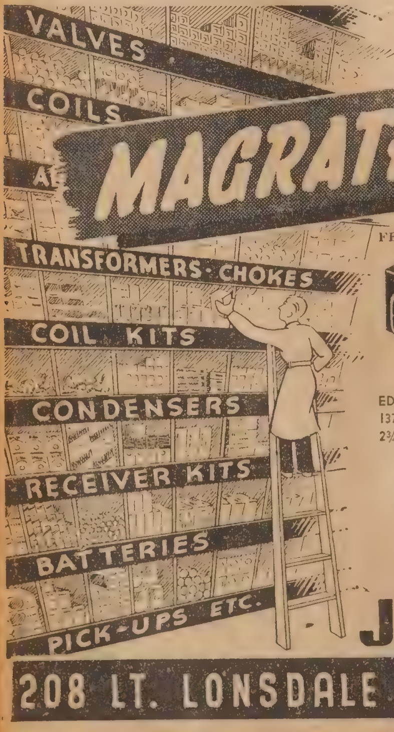

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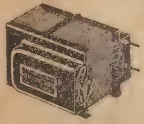

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FOR THE JUNIOR EXPERIMENTER

COILS FOR SIMPLE RADIO SETS

Coils are to be found in all shapes and sizes in radio equipment ranging from elaborate communication receivers to simple crystal sets. In this article we are going to talk about the type of coils used in the inexpensive sets which are so popular with our readers.

A CRYSTAL SET, for instance, might use an arrangement such as that shown in Fig. 1. Here we have a coil and condenser connected to form a tuned circuit. A tuned circuit such as this has the property of resisting the flow of alternating current near the frequency to which it is tuned, at the same time allowing an easy passage from aerial to ground for currents of other frequencies. The ability of the circuit to "select" a narrow band of frequencies is called its selectivity. Good selectivity in a set is very valuable because it allows us to pick out a station we want from the hundreds of others which are operating at the same time and near its frequency.

AERIAL LOADING

The circuit of Fig. 1 is not ideal, because when the aerial is connected it "loads" the tuned circuit quite heavily and reduces the selectivity.

Figure 2 shows another smaller coil coupled to the original coil so that the two make a radio frequency transformer. This is a much better idea because it allows the tuned circuit to remain selective and at the same time provides a sufficient transfer of energy from the aerial to the set. The use of an aerial coupling coil often reduces signal strength, but one signal of moderate strength is better than two or three jumbled together.

The regenerative circuit was developed at the beginning of this century. In it some of the amplified energy from the plate circuit of a triode valve is fed back into the tuned grid circuit with the aid of a third coil. This has the effect of reducing coil losses and increasing the gain and selectivity of the set. Pushed to extremes, regeneration will cause the valve to oscillate and act as a generator of radio energy. This phenomena is now a basic principle in radio. In practice the scheme turned out to be a great success.

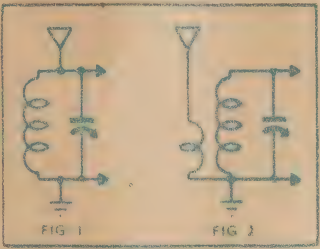
REGENERATION

A one-valve set using regeneration is as good as a set using two or three valves without it. Even today, a quarter of a century later, the use of regeneration is still the best method of getting high performance for the least money.

An accompanying diagram shows all the details of a home-made coil for the broadcast band. It is so simple that it is really only necessary to mention that all coils are wound in the same direction. The rest is self-explanatory. Insulated wire is used with the turns close together.

The regenerative circuit is well adapted for the short-wave bands as well as the broadcast band, and hundreds of enthusiasts have had the thrill of listening to stations from distant parts of the world on a simple one or two valve set.

A system of changing the coils for the various bands which is quite convenient is to bring the various connections to the coil to a valve socket on the set. Each coil is wound on a former which fits the socket. It is then very easy to change coils for either broadcast or short-wave bands.



Showing how an aerial coil is used to avoid loading effects.

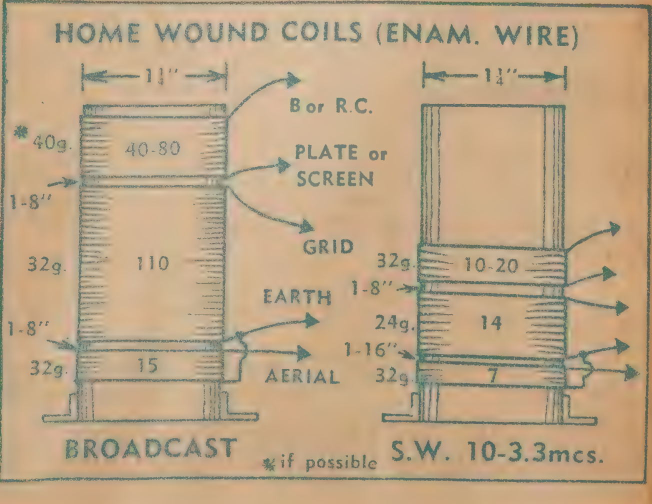
There is nothing difficult about making plug-in coils. The various leads can be brought out to any convenient pin on the plug, provided the connections on the socket correspond. Care should be taken to see that there are no shorts between the various leads on their way to the plug. Fine spaghetti tubing can be used to help with this.

Coil details set out in table form are sometimes a little difficult to follow at the first attempt, so we have shown another diagram of a coil for a popular short-wave band.

Any of the standard circuits such as are described in "Radio & Hobbies" from time to time are suitable. With some circuits it may be necessary to make slight adjustments to the feedback winding. If the reaction is too lively and cannot be turned right off, the idea is to take a few turns off the coil. If, on the other hand, the set fails to oscillate, or just comes into oscillation with the control fully advanced, a few more reaction turns are indicated. Note, however, that the set will not oscillate if the connections to the feedback winding are reversed. The specifications given will be found generally suitable in most cases, but we mention the above just in case.

AERIAL

If you are lucky enough to be able to erect a long and well elevated aerial you may find that the set is too unselective, due to extra loading effects of the aerial. The cure is to take a few turns off the aerial coil, or to move it further away from the grid coil. A short indoor aerial may need a few more turns on the aerial coil than those specified. In most cases, however, the difference will be very little, if any.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ADDING AN AUDIO STAGE TO ONE-VALVE SET

THE extra valve may be placed before the detector, or it may take its place after the detector. In the first case, it would perform in the role of a radio frequency amplifier, while a valve used after the detector would act as an audio amplifier.

A valve used as an audio amplifier must, in addition to increasing the amplitude of the audio voltage from the detector, be capable of supplying power to the speaker or headphones.

Certain valves are designed especially for this purpose and are listed in valve data books as power-amplifier triodes or power-amplifier tetrodes or pentodes, depending upon the number of elements contained in the envelope. The five-element valve, the pentode, has, in addition to the "screen," a suppressor grid which is usually connected internally to the cathode or the negative side of the filament.

SENSITIVITY

Generally speaking, the tetrodes and pentodes are more sensitive than their triode brothers, and in many cases the former types are used in preference. The major reasons for this favoritism is that they require a lower input voltage to the grid than do triodes for the same output and the necessary negative bias voltage is very much lower.

One exception is the zero bias-class B triode, which has two sets of elements contained in the one envelope, and is designed for special applications.

The lower drive requirements of the pentode or tetrode allow us to feed the output valve direct from a diode detector stage and still realise most of the power output of the valve. Such an arrangement was employed in the circuit of the "Little General" set.

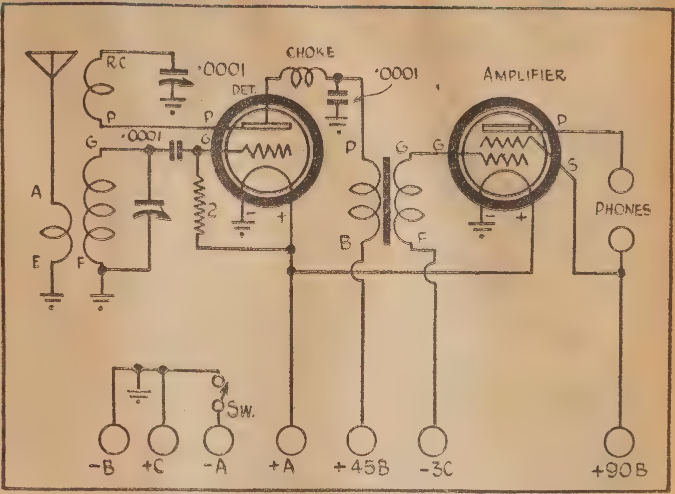
The triode power valve has a particularly low percentage of harmonic distortion, which is the main reason why this type is still being used in high-quality amplifiers and radio sets.

R.F. STAGE

An RF stage does not greatly increase the volume of stations already strong. It does, however, increase the sensitivity and selectivity of a set, and this is a valuable feature when a good portion of the listening is carried out on the crowded short-wave bands, both commercial and amateur.

Nevertheless, we will discuss the addition of an audio stage in this article and cover the addition of an RF stage in a subsequent article in this section.

A good proportion of one-valve sets employs battery-type valves, and hence our circuit illustration shows this type. You will note that the detector portion of the circuit is quite conventional. Full discussion of such a detector was given in a previous article in this section.



Typical circuit showing how an audio stage is added to a single valve set. The bias voltage of 3 volts is suitable for the 1L5G or 1D4. The 1Q5GT requires 4.5 volts, and other types may call for various valves. Always be careful to see that filament, bias and high tension voltages are correctly selected.

The type of interstage coupling is open to variation, there being, in the main, three types. These are transformer coupling, such as depicted in the circuit, resistance-capacity coupling, and choke-capacity coupling.

Resistance-capacity and choke-capacity couplings are much akin in that the components forming the coupling network comprise firstly a resistor or a choke connected in the plate lead and acting as the load for the driving valve (say, the detector), a condenser from the plate end of this resistor to the grid of the next valve, and a resistor from the grid of the second valve to earth or negative bias source, be it batteries or a back-bias resistor.

AUDIO TRANSFORMERS

The audio transformer may be of any of the common primary to secondary ratios, such as 3½ to 1, 5 to 1, or even 7 to 1. Where high fidelity and good frequency response is required, such as in high-quality amplifiers and radio receivers, interstage coupling transformers must, in addition to bringing about a match of the impedance, have a primary inductance which presents an adequate load to the driver at the lowest audio frequencies desired to reproduce. Other factors such as leakage inductance and distributed capacity also apply. These points, naturally, do not worry us in this little project, so any interstage coupling audio transformer nestling in the junk-box will suffice. But they are matters which worry the designer when making.

The only other component in this simple stage is the valve. A few of the suitable types are the 1L5G, 1D4, 1F4, 1F5G, 1G5G in the two-volt filament series, and the 1Q5GT, pentode portion of the 1D8GT, 1S4 and 3S4, 3V4 in the 1.4-volt filament series.

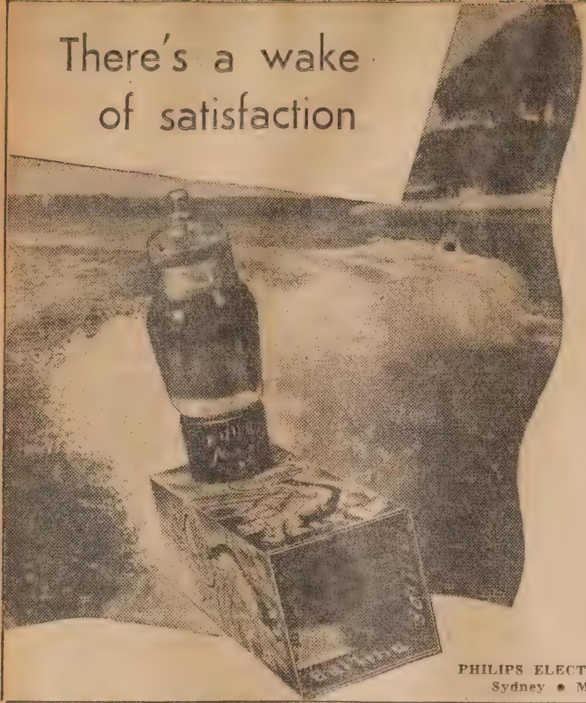
SPECIAL FILAMENTS

The 3S4 and 3V4 types have the filament in two halves with three leads connecting to the base-pins. These leads are the two outside ends of the filament and the centre-tap. For 1.4-volt operation, the two ends are connected together and 1.4 volts applied between this connection and the centre-tap. For 2.8-volt operation, the filament battery is connected to the two outside ends, while the connection to the filament centre-tap is not used.

In the 1.4-volt series, the maximum rating of the valves is 90 volts. In the two-volt series, the first two types have maximum ratings as high as 180 volts, while the others are rated at 135-volt operation. Generally speaking, in each series, the higher the plate voltage, the higher the necessary bias will be.

HEADPHONE CONNECTION

A word of warning. It is not advisable to use headphones connected directly in the plate/screen circuit of the output valve where the voltage exceeds the 150 or 180 mark. The reason is that these voltages can give an unpleasant shock on that tender portion of the anatomy, the ears, if accidental contact is made with the earpiece connections whilst handling or touching the chassis while the power is switched on. The use of an output transformer is, of course, the solution.



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FROM THE SERVICEMAN WHO TELLS

The "victim" of this little piece is a man whose name is known internationally. However, that does not prevent us from drawing a lesson from a recent experience which involved him. Here's hoping he doesn't read "Radio & Hobbies" though or I'll have to answer for my remarks.

As a change from doing this and that, Mr. —— spends a certain amount of time listening to local radio programmes and playing over some of the records in his collection. For the purpose he has a commercial radiogram of conventional type.

He greeted me the other day with the news that the records sounded rather harsh and noisy—an effect which we technical fellows define as distortion. He drew the conclusion that it must be in the pickup, because the set sounded quite normal on radio programmes. Add to this the fact that a couple of very junior relations have been playing with it and there was not much doubt about his diagnosis.

The ability of a set to play without distortion on radio but not on pickup normally means trouble in the pickup, although the method of its connection into circuit can have an important bearing on results. If reproduction is poor on both signal sources, the chances are that the audio circuits of the receiver are at fault. But let's get back to the story.

ARMATURE CENTRE

Magnetic pickups are fairly robust devices but a solid knock will sometimes force the armature over against one pole piece, where it will come to rest. In the normal way, the armature rests centrally between the pole faces, so that the magnetic attraction either way on it is balanced. It is maintained in position by a couple of small scraps of live rubber, which also provide mechanical damping.

But the assembly can get out of alignment and the rubber lose its resilience, so that the armature assumes other than a central position. And, if the rubber is in very bad condition, the needle and armature assembly tend to rattle from side to side instead of working smoothly between a pair of miniature rubber cushions. Replace the shock-absorbers on your car with a few links of stout chain and you will get the same general effect.

On second thoughts, it would be simpler to take my word for it!

Pickups can be re-rubbered if you know how, and I suggested to my friend that he may be able to remove the pickup bodily and give it to me for attention. But watch the mounting and the connections, I warned, and don't try to remove the pickup if the connections are soldered to other wires going to the motor and chassis.

NEEDLE WEIGHT

A couple of days later he reported that the pickup leads were soldered but that he had nevertheless tried to dismantle it. Not achieving success, he had re-assembled the pickup but still had a spring left over.

I have yet to see the result of his efforts, but guess that the spring is from somewhere down under the arm to relieve the weight of the needle point. Quite an important item, I would say, considering that the weight is likely to be around three ounces with the spring in position. Still, I suppose there are plenty more records in the shops.

Actually I made an error in suggesting that he should touch the pickup at all. His interests are in other fields and items like soldering irons and screwdrivers are well outside the scope of his normal activities. However, it will not be a hard job to put things right for him.

Unfortunately, stories like this one do not always end so happily and I have frequently come across examples of receivers much the worse for ill-advised tampering on the part of their owners. I am therefore heartily in agreement with the editorial policy of this magazine, which avoids comment on commercial circuits and discourages non-technical listeners from trying to tamper with the "works."

It is quite a different matter if a man builds his own receiver, as so many "Radio and Hobbies" readers do. The very fact that he tackles the job indicates that he has some appreciation of the problems and requirements involved and the whole thing is a hobby with him, which he learns by tinkering and experimenting.

POOR ECONOMY

But so many folk who try to fix their own receivers do so purely with the idea of saving the few shillings which would represent a serviceman's fee. They fiddle and poke around the chassis without the foggiest notion of what they are looking for and as often as not get around to the bright idea of tightening all the nuts and screws which the manufacturer has apparently left loose. They could not be expected to know that these nuts and screws are for alignment purposes, requiring to be adjusted with great care if the receiver is to do its job properly. When the serviceman ultimately arrives on the scene, he is faced with the double problem of locating the original fault, as well as having to align the receiver all over again. And, if the owner tactfully refrains from mentioning his attentions to the chassis, one can waste a lot of time locating the double-barrelled fault.

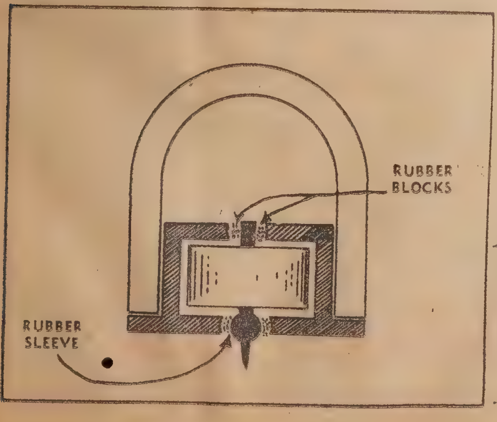
HUM TROUBLES

Last but not least a few receivers have iron-dust slugs which are adjusted directly by a screwdriver or special spanner. A few moments of inexpert attention with a wrong-size driver or a pair of pliers can just about ruin a perfectly good IF transformer.

Forgive me if I appear to be ranting a little, but I have a particular aversion to repairing the misdeeds of others who have tried so hard to make my call unnecessary.

Over a cup of afternoon tea, the Technical Editor mentioned recently that there had been a number of complaints recently of hum trouble in receivers. Not that hum troubles are any more acute now than they have ever been, but simply that complaints often seem to come in batches and appropriate comment is made.

From the serviceman's point of view, complaints of hum are usually associated with electrolytic condensers, which gradually lose their capacitance.



Illustrating the general set-up of a magnetic pickup head, and the rubber damping which centres the armature.

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9006	1	0	0	
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12SF7GT	1	0	0	
12SA7GT	1	1	3	
12A6	1	0	0	
12SG7	1	0	0	
12SH7		19	6	
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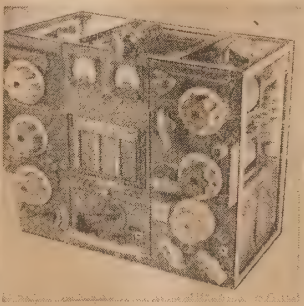

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.01	5000	,,	BLOCK	4/6
.01	4000	TEST	,,	2/-
.01	3750	WKG.	TUB.	2/6
02	8000	,,	,,	5/-
023	450	,,	,,	9d
.025	6000	,,	BLOCK	4/6
.03	5000	,,	,,	5/6
.1	1000	,,	TUB.	1/9
.1	2000	,,	BLOCK	2/6
.1	3000	,,	TUB.	2/9
1	4000	,,	BLOCK	3/-
1	6000	,,	,,	3/-
.25	2000	SUBD	,,	3/-
.25	6000	SUBD.	,,	6/6
.25	6000	TEST	,,	3/6
.25	2500	WKG	,,	3/3
.25	1000	,,	TUB	3/-
1	1500	,,	BLOCK	7/6
1	2000	,,	,,	8/9
2 MFD.	350	,,	TUB.	2/6
2	500	,,	,,	2/6
2	800	TEST	,,	1/6
2	1000	,,	BLOCK	2/6
3	2500	,,	,,	8/6
4	1000	WKG.	,,	10/-
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4 MFD.	2000	TEST	BLOCK	10/-
8 x 8 x 8	45P.V.	Electrolytic	TUB.	8/6
8 x 8 x 8	500	,,	BLOCK	8/6
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50	12	,,	,,	1/3
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Unlike paper condensers, the capacitance of an electrolytic relies on a chemical property, and, when the chemical dries out or is otherwise impaired in its properties, the condenser ceases to function properly. A hum gradually develops and sooner or later the set-owner calls in a serviceman to instal new condensers in the filter system. Once this is done, the hum level recedes to whatever it was when the set was new.

Complaints of hum for other causes are infrequent, since the set-owner grows accustomed to a small amount of residual hum and only senses that something is wrong when it rises to an embarrassing level. Nevertheless, there are cases where a listener becomes hum-conscious and replacement of filter condensers is in itself not sufficient.

A couple of months back I mentioned hum of a mechanical nature, which necessitated tightening transformer bolts and packing the chassis up a little off the shelf in the cabinet. This was a case where a combination of random resonance effects was causing the cabinet itself to vibrate in sympathy with a 50 cycle vibration in the transformer.

LACK OF FILTER

But, in the majority of cases, the residual hum is simply due to limited filtering and to other circuit peculiarities. Sometimes one or more 8 mfd. condensers in parallel with the existing filter units will reduce it sufficiently. In other sets, it is necessary to add another complete section to the filter, involving a choke and an additional electrolytic condenser.

However, there are cases where additions to the filter system make no difference to the residual hum and where there is no obvious shortcoming in regard to such matters as inadequate shielding or improper earthing of the heater circuit. In nearly all such cases, the residual hum is traceable to the effects of eddy currents in the chassis.

The power transformer is surrounded by a strong magnetic field, and it affects the steel chassis to some extent. A 50-cycle magnetic flux in the chassis inevitably means that there are 50-cycle voltages between various points on the chassis, and these can easily be injected into a grid circuit to appear in the output as hum.

It may be suggested that the voltages appearing in a chassis due to eddy currents must be very small, and such indeed is the case. But so also is the voltage required to produce a noticeable hum in the output of a receiver or amplifier.

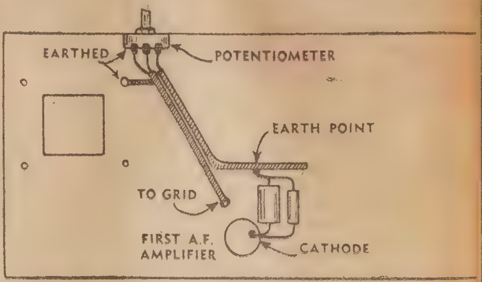
If you enjoy working things out, you can begin by assuming the very few milliwatts of power necessary to produce an audible residual hum in a sensitive loudspeaker. Then calculate the hum voltage this represents, the overall gain of the amplifier system and finally the 50-cycle input signal necessary to produce the hum. You will find that the answer to your calculation lies very much the right of the decimal point.

However, it is not necessary for the present to indulge in such a pastime. You can take my word for it that hum due to eddy current effects is very troublesome in high gain amplifiers and can be evident under adverse conditions in an ordinary receiver.

The classic set-up for hum injection is illustrated in the accompanying sketch, which is typical of a large percentage of ordinary 4/5 valve receivers. The first audio amplifier valve is situated about halfway along the rear of the chassis, with the volume control at the front and the power transformer situated to one side of the intervening space.

The cathode is normally returned to chassis—directly or through its bias network—at a point fairly close to the socket. But the grid lead runs from the top cap or grid pin down through the chassis and right across to the volume control. The signal input lead to the control generally runs parallel with it on its way back to the diode circuit. These two "hot" leads are always shielded to prevent instability and capacitive hum pickup, but the shielding offers no protection whatever against magnetic effects.

Poor arrangement of volume control leads leads can cause hum troubles in receivers if correct earthing technique is not followed.



CONTROL WIRING

The difficulty arises when the circuit calls for earthing one side of the volume control, as distinct from returning it to a cathode pin. There is no technical objection, mind you, to earthing one side of the volume control if the circuit requires it, but the method of wiring actually leads to the trouble.

The normal procedure is to earth the braiding near the valve-socket. It is also joined to one lug on the potentiometer, which is then soldered across to the metal cover and earthe again to chassis via the spindle o the control.

The input circuit to a valve comprises everything between the actual grid connection and the actual cathode pin. Tracing this through on th illustration, the grid lead runs righ across the chassis to the potentiometer; then through the resistanc element and back to the cathode return point via the devious paths provided by the braiding and the chassi itself. The chassis provides the lowest resistance path and is therefor well and truly in the grid-cathod circuit.

Unfortunately, this return circui includes that section of the chassis which is most affected by eddy currents, so that the ripple voltage developed across the surface of the chassis is effectively injected into the grid circuit of the first audio-amplifier. The worst "blue" of all is to tie any of the wiring to a solder lug beneath a transformer bolt, which is generally a focal point for eddy current effects.

COMMON EARTH

In the light of this, the obvious cure is to use a single common earth poin for grid and cathode returns. When wiring a receiver, therefore, insta the cathode bias units between the cathode pin and a convenient nearby earth point. Run the shielded leads past this earth point and then straight up to the lugs on the volume contro without allowing the braid to touch any other earth point on the chassis The earthed lug on the control should be joined to the shielding, but not to the cover of the potentiometer, if this is electrically connected to the spindle as with so many modern controls. If the cover is not so connected, it can be joined to the earthed lug without introducing any difficulties.

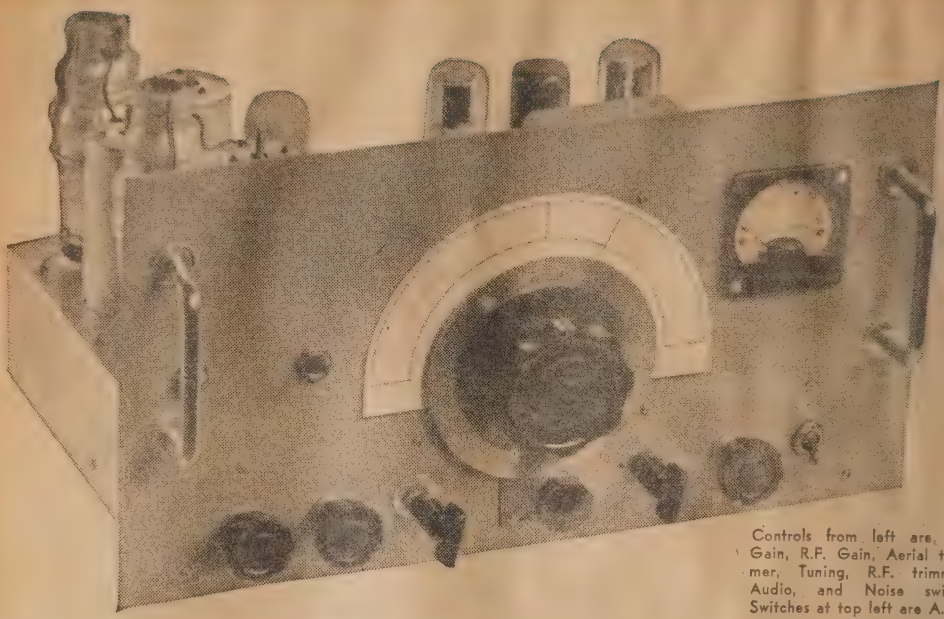
Modified in this way, the cathode and grid circuits both return to one point on the chassis and eddy current effects are not likely to be apparent, assuming average audio gain.

Since setting out to write these paragraphs, I have called to mind a case a few months ago of a typical 4/5 receiver. No additions to the filtering or modifications to the heater wiring made any difference, but I did notice that the grid wiring was wrongly installed. By breaking all the return circuits other than the one near the valve and lifting the braid clear of the chassis, the hum level subsided from an annoying background to virtual nothingness.

NEXT MONTH

IN next month's issue we hope to describe a T.R.F. tuning unit for use with the amplifier described this month. If possible, we will include information on a bass-compensated pre-amplifier stage, together with some ideas on obtaining bass boost in the amplifier itself.

The issue will carry at least two other full scale technical articles, pages for beginners, and so on. Make sure of your copy by placing an order with your newsagent.



Controls from left are, I.F. Gain, R.F. Gain, Aerial trimmer, Tuning, R.F. trimmer, Audio, and Noise switch. Switches at top left are A.V.C. and B.F.O.

A receiver for 50 megacycles

This is a splendid set for the 50 megacycle band, built for high gain, smooth operation, high sensitivity. It handles just as easily as a set on the broadcast band, and its noise limiter is exceptionally effective particularly on car ignition and other similar sources of interference. Although it has ten valves, there is nothing particularly difficult about its construction.

by
John Moyle
VK2JU

HAVING experimented at some length with receivers and converters for the 50 megacycle amateur band, we decided a few weeks ago to build up a complete receiver incorporating most of the "lessons learnt" during the course of the said experiments.

We weren't anxious to limit ourselves to any particular number of valves—we wanted good sensitivity and performance generally, freedom from excessive pulling, ganged tuning, reasonable selectivity, together with AVC and all the features one looks for in any other type of set.

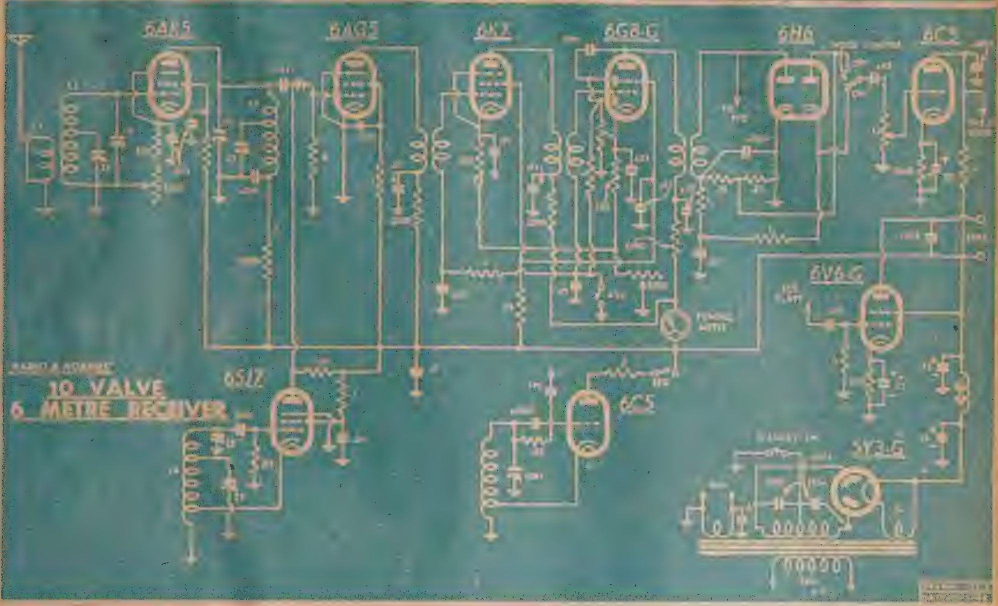
The job which resulted has shown itself to be capable of all these things. It has tuned in all the stations we normally hear, and has done so more easily and with better signal to noise ratio than with any of the set-ups used to date. It is particularly smooth to handle. There is no oscillation when correctly adjusted, and the AVC-tuning meter combination is just the thing for ironing out the signals and giving comparative strength measurements.

The noise-limiter—quite a well-known and absurdly simple circuit—is so good that we haven't bothered trying to improve upon it. The noise-level at 2JU is pretty terrific, being a combination of motors, neon signs, X-ray machines, and so on. It is an ideal location for a test of a noise-limiter. When all this mess starts up at the same time, there is virtually an S9 roar all over the 50mc. band. In it all but the strongest stations are completely masked. But when the noise-limiter is switched on, this roar disappears like magic, and allows signals of the S3 variety to be fully copied from stations up to 200 miles away.

Naturally enough, the nearer the noise is to a complete continuous blackout, the less efficient is the limiter. However, for the average man bothered with motor cars and the like, it will mean virtual elimination of the nuisance in a manner almost too good to be true.

There are quite a number of approaches to set design for the higher frequencies. Most of the problems centre round the r.f. stage, if any, and the converter valve. It is the

CIRCUIT DIAGRAM OF THE SIX METRE RECEIVER



The circuit may be considered as basic—minor modifications are in order to accommodate alternative valve types.

old problem of gain versus noise-level, except that both are somewhat more difficult to control than on the lower bands.

The subject has too many ramifications for a full treatment here, and, even if it were given, results would include the quotation of so many "ifs" and "buts" as to be somewhat misleading to all but the near-engineer.

In general terms, we have found that it is possible to get appreciable gain from modern pentodes of the EF50, 6AK5 class without the introduction of excessive noise. Even the acorn valves, although giving much less gain than the types mentioned, are worth while as RF amplifiers. We have used two such stages with success, through the medium of a pre-amplifier running ahead of this set.

SECOND STAGE

A second R.F. stage, however, introduces complications, mostly physical, as, for instance, the difficulty of obtaining a suitable four-gang condenser. Stability, too, is progressively harder to obtain for the average builder. It is better, therefore, to use a single stage giving good gain with no tendency to regenerate, than to use two which might possibly not work out so well. Oscillation and regeneration are fatal if good signal-to-noise ratio is required, and the average builder would do well to use a single stage at least for a start.

Grounded-grid triode amplifiers are very effective in providing very low noise level, but for frequencies below 100 mc, this advantage does not appear to offset the higher gain given by the pentodes. The same in general seems to be true of triodes as mixers, apart from the several other problems they introduce in circuit design. Moreover, there seems little point in striving for noise level improvements which are often so small as to be measurable only in a laboratory if the noise introduced when the aerial is couple is comparatively so large as to completely swamp the improvement.

However, we seem to be on th verge of entering into the very discussion we wish to avoid. Mayb we had just better conclude thi part of the description by saying tha we decided on one RF stage, usin a high-slope, VHF type of pentode with a similar type used as a grid

There is room for three coupled tuning condensers, as the small job shown was ex-Disposals. Note tin-plate shields round R.F. and mixer valves.

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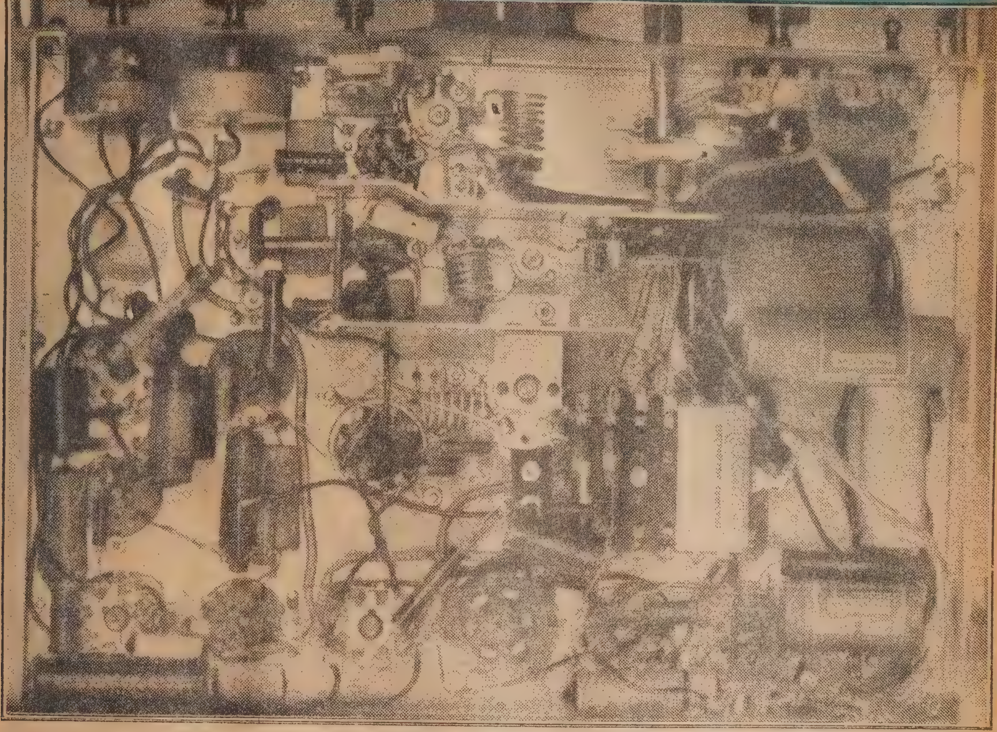
UNDER-CHASSIS VIEW OF THE SIX METRE SET



The coils are in shielded compartments. The oscillator padderis a midget variable mounted on the shield. Take great care to keep R.F. leads short. Plate lead to mixer, and injection voltage lead run through shields. Valve socket at lower centre gives power for a pre-amplifier stage when it is used.

leak biased, grid injected mixer. This type of mixer is possibly the most sensitive of them all. A very popular circuit giving less gain with possibly better stability and less noise is the anode-bend type, illustrated herewith by a minor circuit. Both these mixers are good, and our choice of the one doesn't imply that it is so much better.

OSCILLATION

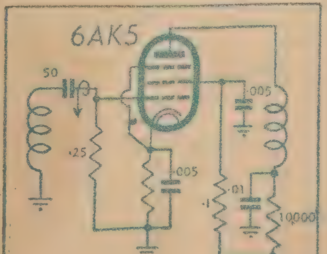
Incidentally, should you be troubled with oscillation due to high gain in the converter, the addition of a 300 ohm cathode resistor bypassed with .005 mfds mica condenser will almost certainly cure it with little effect on performance. In our circuit, the mixer is biased entirely by the rectified injection current from the oscillator, and sometimes a little standing bias is a good thing.

Coupling between stages is by means of the simple tuned-anode system. The loading effect of the plate and grid circuits on this coil reduce its size to about one turn less than for the RF grid coil—otherwise there is nothing difficult here.

The oscillator itself may be almost any pentode from the 6SJ7 upwards. All we require is a stable oscillator which will produce quite a small injection voltage. The very high-mu valves such as the 6AC7 may tend to super-regenerate, but even they can be used. Ours in fact was a 6SH7 merely because we had it on hand.

SUITABLE TYPES

Triode oscillators are often used, but we have found better circuit isolation and freedom from pulling, &c. to follow the use of the electron-coupled pentode.



Circuit showing 6AK5 as anode bend mixer. Other valves are O.K. with appropriate voltages.

Valves for the RF and mixer may be 6AK5, 6AG5, EF50, cr, with less gain, 954. The 6AC7 would work quite well, but its very low input resistance is against it. The EF50 might well be the best all-rounder, although the 6AG5 is a hard valve to overlook if you can get it.

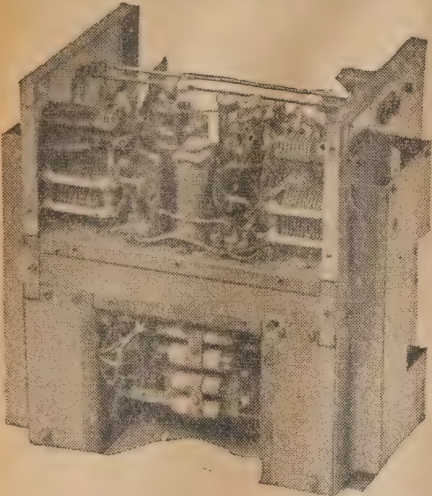
Note that the 6AK5 runs with 180 volts plate and 150 volts screen as maximum. The 6AG5 runs with 250 plate and 100 screen, while the EF50 most conveniently runs with 250 volts plate and screen.

The tuning coils are mounted on small ceramic strips close to the valve sockets and the lead from the bandspread gang. The shields between them are important, and could straddle the valve sockets, if physically convenient, for better shielding. We didn't find this essential.

FIRM CONSTRUCTION

Use heavy wire when wiring to the RF end, particularly the oscillator. It must really be firm, so firm that you should be able to pick the set from the table and even weave the chassis without losing a strong signal. Poor mechanical stability is an everlasting nuisance.

RADAR TRANSCEIVERS



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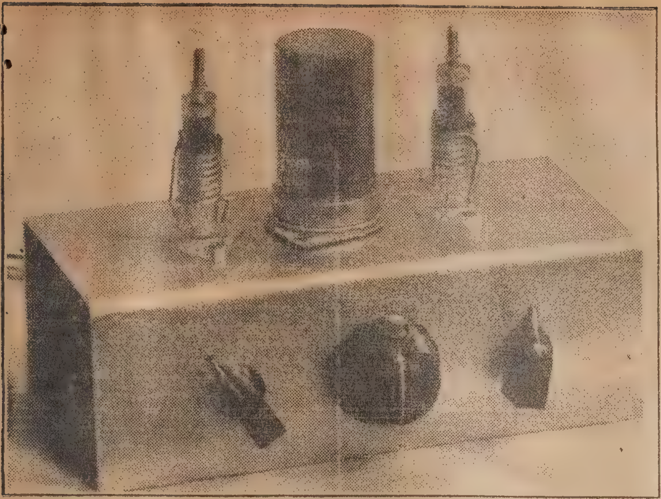


A pre-amplifier made with adjustable iron cores, the circuit given below. The metal can of the EF50 apparently gives adequate shielding between coils, although extra shielding may sometimes be required.

The IF channel is conventional, using 1.9 mc. intermediates. These will give plenty of gain using normal valves, and the selectivity we have found acceptable for the band, where extremely sharp tuning isn't altogether required. It is high enough to avoid too much pulling of the oscillator, which with the converter properly adjusted, is hardly noticeable.

We have already discussed the second detector and noise limiter circuit. As will be seen, the extra components required are very few. The 6G8G is still used for AVC, but a second 6H6 could be employed here if a 6G8G type isn't available. There is a spare socket hole on the chassis.

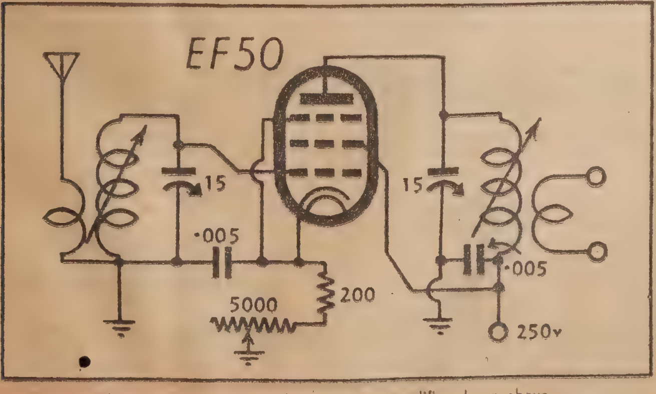
Any standard audio end can be used. The triode pentode gives plenty of gain, and happened to be convenient.

The BFO is also a straightforward circuit. In order to avoid random coupling, we built the unit on a chassis of its own and mounted this on top of the chassis proper. This gives good control of injection, although, frankly, the random coupling method was quite all right. An iron slug trims this coil, and a variable pitch condenser could be included if you so desire.

SOME POINTERS

Now a few points. Coupling between mixer and oscillator is made by twisting together about half-an-inch of plastic hook-up wire until oscillator pulling begins to be excessive. The wire is then unwound until a point is reached when trimming the mixer circuit detunes a strong signal without losing it. This seems to be about the best general setting for both mixer circuits. Too light coupling will show reduced sensitivity. It is this reduction which really sets the minimum amount of coupling.

With the coil data given, the coils should trim by adjusting the 3-30



The circuit of the general purpose pre-amplifier shown above.

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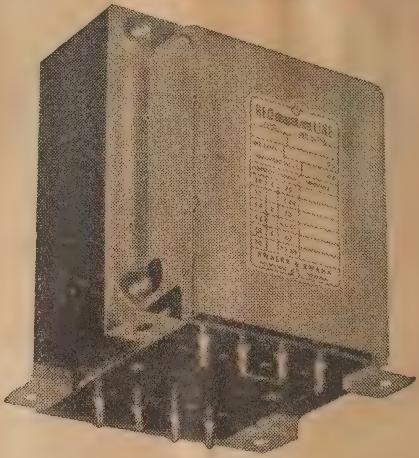

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trimmers mounted across aerial and RF. You should tune in stations with the oscillator midget trimmer fairly well in. Choose the low side for the oscillator rather than the high side in the interests of stability. Having found stations and placed them correctly on the dial, adjust the trimmers for best results with the hand-trimmers about half in. Test for tracking by noting how much movement is required on the hand-trimmers to keep circuits in trim over the full dial sweep. If capacity has to be added, the respective bandspread tap should be moved further up the coil, and vice-versa.

TRACKING

Our set tracked quite well without requiring soldering gymnastics, and the hand-trimmer variation is only a few degrees either way.

The amount of bandspread will be set by the position of the oscillator coil tap. The other two merely track with this setting. We made our set cover the band with about 15 degrees overlap at each end.

The vernier dial is a plain type with a small rubber roller attachment to give slow-motion tuning. These attachments can be bought here and there from "disposal" houses. Quite good tuning is possible even without it, or you can improvise one with a spindle and a rubber grommet.

The tuning meter is a disposals 5-mill movement type shunted with a 5-ohm resistor. This gave nearly full reading with no signal, and a strong indication on loud signals. Only the i.f. stages are controlled.

The coils are half inch diameter of 16 gauge wire. L1 has four turns, L2 seven turns tapped at 3½, L3 six turns tapped at three, and L4 has five turns tapped at three.

Our chassis measured 12 x 9 x 2½ inches, and the panel 14 x 7½ inches. These happened to be handy, and allowed just nice room for everything.

PRE-AMPLIFIER

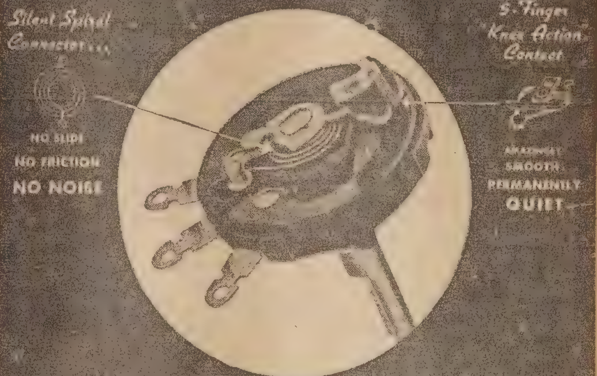
There is nothing much to the pre-amplifier, which is included as a matter of interest, and which can be added to almost any set. If you have no RF stage now, it should make a big difference. It was originally an "S-niner," but we found it was stable and worked much better with tuned circuits. The iron-cored coils are not essential, but are handy to peak circuits if you make an S-niner of it. It will require adjustment on widely separated signals for best results.

Coupling to the set is via a short length of parallel flex or co-axial cable.

The formers shown are convenient because they can be mounted on the 7½ x 3½ x 2½ chassis, the coils wound separately, using heavy gauge wire, and then slipped on the formers and soldered to the connecting wires. Removing turns is easy, as the whole coil can be taken off.

QUIET

PERMANENTLY



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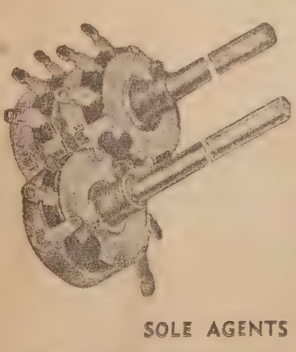

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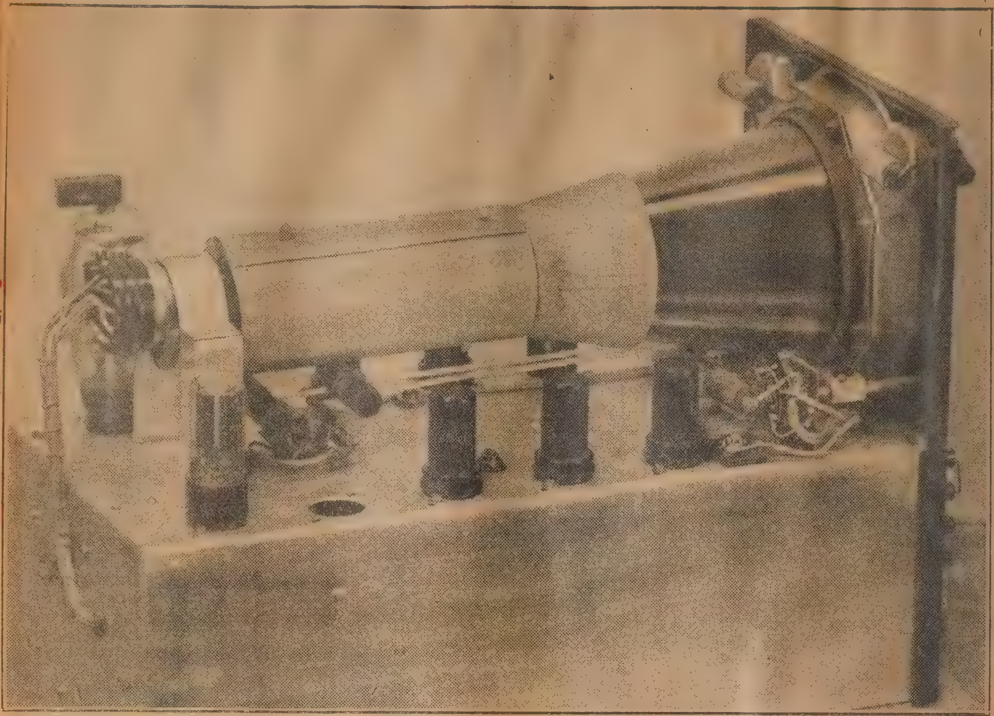


This picture shows the additional valves, three in number. The spindles of the two balancing potentiometers are also visible—they are located almost between one pair of valves.

YOUR 5-INCH OSCILLOSCOPE

with push-pull deflection

This article deals with the addition of push-pull deflection to last month's oscilloscope. This addition greatly improves the trace on full scale deflection, and is made without alteration to the basic circuit.

IN elaborating on the initial design, the first obvious addition is a system of push-pull deflection for both sets of plates. The chief advantage of this is in the improved clarity of the trace near the edges of the screen, due to elimination of defocusing on wide excursions of the spot.

The reason for this is not difficult to understand. When there is no signal applied to the deflector plates, they are all at much the same potential, and the beam is focused to a spot in the centre of the screen under these conditions.

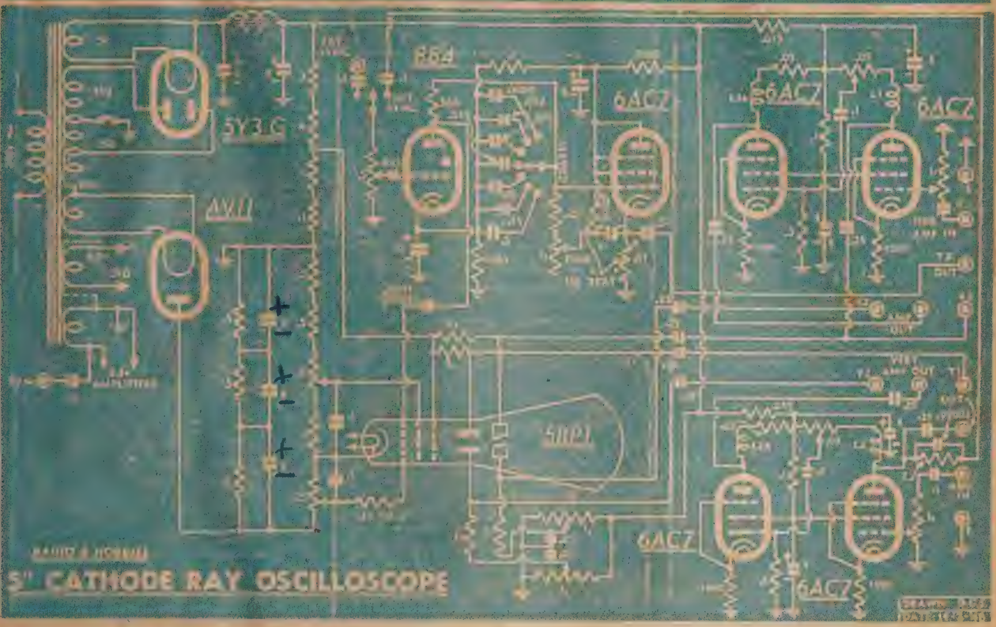
With single-sided deflection, one plate of each pair remains at the same potential, while the opposite plate is swung alternatively positive and negative with respect to its initial potential. On the positive excursion, the beam is bent towards the active plate, and the additional positive potential has an accelerating effect on the electron stream—sufficient to throw it slightly out of focus. On the negative excursion its effect is just the opposite, the beam being repelled and the electron stream retarded slightly—once again producing defocusing.

The effect is only really serious for extremes of deflection, and, even then, it is not sufficiently so to render the pattern useless. But it is, nevertheless, undesirable in a laboratory type instrument.

The addition of push-pull deflection means that one deflector plate swings positive while its opposite number swings negative by the same amount. The two out-of-phase voltages tend to cancel out in their effect on the electron beam, so that defocusing is avoided or at least reduced to a degree where it is of little consequence.

In most cases, an oscilloscope is used for inspection of unbalanced—

REVISED CIRCUIT OF THE FIVE-INCH 'SCOPE



Here is the new circuit showing how push-pull deflection is simply added to the single-ended circuit described last month.

or single-sided—voltages, so that some form of phase inversion must be used to obtain a push-pull output voltage.

The problem is much akin to that encountered in push-pull audio amplifiers, and the same general methods suggest themselves to achieve the desired result. In the present case, we had to consider the availability of valves, matters of convenience and sensitivity, the high frequency response of the system, and, finally, the simple economics of the matter.

SIMPLE CIRCUIT

Without discussing all these points in detail, we elected to use a simple phase inversion system, involving a second 6AC7 in each case, deriving its signal from the output circuit of the original amplifier.

In audio equipment it is usual to tap the second grid into the grid circuit of the upper output valve, thereby obviating the need for an additional coupling condenser, and making possible the use of a self-balancing circuit. In this case, the grid is replaced by a deflector plate circuit of very high impedance, and, considering the input capacitance of the 6AC7, we could not expect very good high frequency response from the lower half of the push-pull system.

Furthermore, the self-balancing feature is unimportant, since the CR tube itself offers a ready means of adjusting the balance of the push-pull circuit.●

Accordingly, we arranged to feed the second amplifier valve directly from a tapping in the plate circuit for the first valve. For this purpose, the plate load is split into a fixed 25,000 ohm resistor and a potentiometer of the same value mounted between the amplifier sockets. Excitation for the second grid is led off through a coupling network from the tapping on the potentiometer. Adjustment of the potentiometer will ensure that the second valve is fed with a signal equal in amplitude to the original signal, but of opposite phase.

In the first instance we simply connected the cathodes of the push-pull valves together, and the screens, and left them unbypassed. This would normally obviate degenerative effects and the need for heavy bypassing. However, there was a definite tendency to instability under these conditions, so that we finished up with the cathodes independently biased and unbypassed, and a common heavily bypassed feed to the two screens.

The same system is used for both sets of amplifiers. The gain of the

PARTS LIST

Chassis 17½ in. x 8¾ in. x 5½ in.

Front panel 12½ in. x 9⅛ in. x ½ in. (inside).

Case 18½ in. x 9⅛ in. x 12½ in. (outside).

Power transformer 350v. ct. 350v. 900v. 6.3v. at 1A (shielded), 6.3v. at 2A. (see text).

1 20mA. filter choke (see text).

1 7-position single bank rotary switch.

6 octal sockets, 1 11-pin CRO socket.

1 5-pin wafer.

RESISTORS

5 2 meg., 8 .5 meg., 1 .25 meg., 1 .2 meg., 6 .1 meg., 2 .05 meg., 1 .035 meg., 1 .025 meg., 2 .015 meg., 1 .01 meg., 1 3000 ohm., 1 5000 ohm., 4 1000 ohm., 1 500 ohm., 5 1 meg. potentiometers, 2 .5 meg., pot. 1 .25 meg. pot. (with switch). 2 .05 pots.

L1, L1a, L2, L2a 60 turns 35 SWG enamelled wire wound on ½ in. dia. resistor (4 or 5 watt type).

CONDENSERS

11 8 mfd., 1 25 mfd., 2 .5 mfd., 4 .25 mfd., 1 .15 mfd., 9 .1 mfd., 3 .05 mfd., 1 .015 mfd., 1 .005 mfd., mica, 1 .002 mfd. mica, 1 .0008 mfd. mica, 1 .0001 mfd. mica, 2000 volt (or 3 .00025 mfd. mica in series), 1 .00002 mfd.

VALVES

1 5BP1 (1802-P1) C.R.O., 1 AV11 (half wave rectifier), 1 5Y3GT, 1 884, 5 6AC7.

SUNDRIES

14 terminals (12 red, 2 black), 9 pointer knobs, indicator plates, 2 insulated couplings, 1 C.R.O. mounting, scrap aluminium, sponge rubber, resistor strips, hook-up wire, tinned copper wire, spaghetti, brackets, carrying handle, rubber grommets, power flex and plug, 4 rubber feet, nuts and bolts, &c.

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VALVE SPECIALS

Type EF50	9/6
807	8/6
EA50	6/6
6J5	9/6

individual valves is thus the same as in the simpler oscilloscope, but the sensitivity of the instrument is doubled, due to the additive effect of the impulses on the two opposite deflector plates.

Another point warrants special mention. There is inevitably a small amount of 100 cycle ripple in the plate circuit of the upper 6AC7, and this is picked up and amplified by the lower valve. Without further enlarging on the point, we found it necessary to provide decoupling in the plate supply to each pair of amplifiers.

SIMPLE ADDITION

Since the instrument had been wired in the first place with an eye to including just these extra features, the addition of the two amplifiers is simplicity in itself. The extra 6AC7 valves have been slipped in place directly behind the original amplifiers, the few extra components falling natuarlly in place.

On the front panel, the upper centre terminal on each side was disconnected from earth and wired to the output of the additional valves. The link is left in position between the adjacent terminals, so that the plates which had hitherto been bonded to earth now receive a signal.

The method of balancing the output of the push-pull amplifiers is not difficult to understand. Feed a sine wave voltage, as pure as possible, into the vertical amplifier terminals, keeping the signal potentiometer for the lower amplifier at zero. The deflector plate normally connecting to the lower amplifier output should also be initially earthed via the .05 mfd. coupling condenser. This is achieved simply by breaking the link between terminals on the front panel and running a wire between the deflector plate terminal and the chassis.

BALANCING

Advance the gain control until a vertical line appears on the screen and this should be set to arbitrary figure, say, 2in in length.

Leaving the input control set, break the link between the upper amplifier and its deflector plate, earthing the deflector plate to chassis and insert the link between the opposite plate and the lower amplifier. Now advance the input control to the lower amplifier until the trace once again becomes 2in long.

The adjustment may be verified by noting that the connection of the second plate to its amplifier instead of to earth doubles the length of the trace.

Exactly the same procedure should be followed in balancing the horizontal amplifiers. It is important that the balancing be carried out on a sine wave input, rather than the sawtooth wave form from the gas triode, since the unusual nature of this signal is likely to confuse matters.

With the amplifiers arranged as above, you will find that an input voltage of about 1.6 is sufficient to sweep the trace over a distance of 4in in either direction, which represents about the maximum useable portion of the screen. This is approximately twice the sensitivity obtained from the single-sided amplifier arrangement. We found that the trace remained in focus over the whole area of the screen and the patterns were generally cleaner than available with the single-sided setup.

Hum content attributable to the amplified arrangement is negligible, a very slight residual ripple being due to direct magnetic fields from the power transformer.

The next point is in regard to the sweep oscillator and measures to render it more linear in its characteristics.

The majority of sweep oscillators utilise a condenser which is slowly allowed to charge, then abruptly discharged—or vice versa. The charge or discharge law of a condenser is exponential rather than linear, and the effect is noticeable on the pattern. Over the section of the sweep where the charge or discharge rate is high, the waveforms are slightly opened out, and compressed where the charging rate is slower.

LINEAR TIME BASE

In the case of the 884 gas triode, careful selection of operating conditions can minimise the non-linearity, so that the sweep is adequate for most purposes. But, once again, for a laboratory instrument, some complication is worthwhile to obtain a more linear trace.

By glancing at the time-base portion of the circuit of the CRO, you will see how we obtained linearity. A pentode valve has been wired as a triode, although any high mu triode valve will perform equally as well.

The success of the circuit largely depends upon how closely the gain of the valve approaches unity. Naturally, the value of the cathode resistor is a controlling influence in this factor, bearing in mind that as the value of the cathode resistor approaches the AC or plate resistance of the valve, so the amplification factor of the valve approaches unity.

OUR CIRCUIT

In this circuit, the 5000 ohm resistor from the plate to the positive side of the 8 mfd electrolytic condenser is, in the AC sense, really in parallel with the 10,000 ohm cathode resistor. Considering the impedance of the 8 mfd condensers at, say, 20 cycles as being in the vicinity of 1000 ohms, it can be seen, by glancing at the circuit, that the impedance in parallel with the cathode resistor will be the 5000 ohm resistor plus the impedance of both of the 8 mfd condensers.

The resulting impedance will vary slightly with change in time-base frequency, hence the reason for the compromise in selecting the values of the two resistors for optimum degree of linearity over the time-base fr quency range.

The functioning of the valve m be viewed in the following manne The 8 mfd condenser at the catho of the 6AC7 is charged and mai tained at reasonably constant pote tial by the 5000 ohm resistor from tl HT supply. The particular time-ba condenser selected by the time-ba "coarse" frequency switch is charg from the potential on the 8 mfd co denser via the "fine" frequency co trol, the 1 megohm variable resis ance in series with the .25 megoh resistor.

OPERATION

At the commencement of tl charge, the grid of the cathode fo lower is negative with respect to i cathode by reason of being connect to the time-base condenser. As tl charge on this condenser increases, i potential rises positively with respe to earth. At the same time, the gr of the cathode follower rises pos tively, causing this valve to dra more and more current. This ir crease in current increases the vol age drop across the cathode resistc which, acting upon the grid as an ir crease in negative bias, maintains tl grid to cathode potential reasonab constant. Alternatively, it could b said that for each positive increas on the time-base condenser there is closely corresponding increase at tl cathode which, really, is an increas in the voltage between the positiv side of the 8 mfd condenser an earth.

The result of this cathode-follow ing action of the valve is that th voltage drop across the charging re sistance remains fairly constan This means that the current throug this resistance maintains the sam constancy, resulting in a change fron the original exponential law of th time base condenser to one which i approximately linear.

OUTPUT POINT

The output from the time bas may be taken from the 10,000 ohm cathode resistor or the 5000 ohm resistor. However, as the input to the time base amplifier has one side a earth potential, the obvious poin from which the output should be taken is the cathode. Furthermore, the output point where the impedence is higher is to be preferred.

A cathode potential of 35-odd volts is not unusual, and as the output is taken to the front panel, a coupling condenser is used. The value of this condenser is set at .5 mfd so as not to reduce too greatly the effective value of the .1 mfd coupling condenser with which it is connected in series when feeding into the amplifier.

This linearising device is simplicity in itself, and for such simplicity the arrangement is worthy of inclusion in any oscilloscope. It consists of one valve and three components. When the 6AC7 was replaced by a triode connected 6SJ7, the value of the two resistors remained practically the same for similar optimum linearity.

As the circuit is open to the use of any high mu triode or triode-

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connected valve, we have shown on the circuit that these resistors may be fixed or variable.

For the constructor who desires to adjust the degree of linearity to suit his own requirements, we would suggest the mounting of two 20,000 ohm potentiometers on the side of the chassis close to the cathode follower valve.

In adjusting these potentiometers for optimum linearity, it will be necessary to provide a means of noting the trace linearity, such as by feeding a sine wave into the Y plate or vertical amplifiers. Throughout the adjustment, arrange the frequency relationship so that there are at least three complete cycles appearing on the screen, and preferably four or five.

Commence by setting the cathode potentiometer at or near its maximum value. Then adjust the potentiometer from HT so that good linearity is approached at the very low time base frequencies. At this juncture, it may be noticed that portion of the last cycle, or the last cycle when there are more than, say, six cycles appearing, is cramped, compared with the others. Reducing the value of the cathode potentiometer will correct this, but, in doing so, keep a check on the change in linearity at the very low frequencies.

By adjusting one potentiometer, then the other, positions will be found where the linearity is optimum throughout the time base frequencies.

At the very low frequencies there is a limit to which the linearity can be adjusted. Beyond this limit the fly-back time is affected, resulting in portion of the trace appearing to double back on itself.

At high time base frequencies, the brightness of the trace may not be uniform. Adjustment of the value of the resistor at the grid of the CRO will vary the amount of fly-back blackout and hence the relative brightness of both ends of the trace.

After both the X and Y plate pushpull amplifiers have been balanced in the manner explained earlier, it may be found that when the time base output is fed to the X plate amplifier, the trace does not expand evenly to each side as the X plate amplifier input control is advanced from zero. This difference, though not great, will vary with change in time base frequency.

This is a characteristic of this type of amplifier when amplifying wave shapes which contain a very great percentage of harmonics, and does not necessarily mean that the trace linearity is altering. It is partially due also to a change in the zero reference level of the output coupling condensers.

The frequency response of the amplifiers is quite adequate for the purpose, being more or less flat up to 10 kcs and with a slight drop up to 30 kcs.

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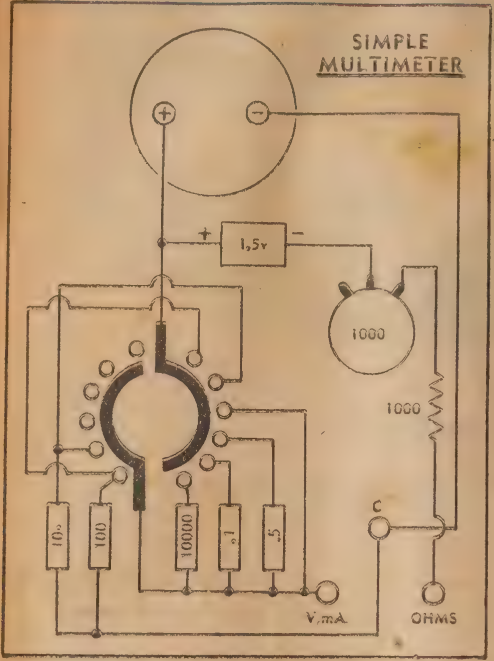


This simple multimeter is an ideal instrument for the beginner because of the very few parts required for its construction. It is cheap to build, compact in size and covers most of the measurements required in ordinary service work.

The circuit and wiring diagram are shown here together, and there is very little to either.

PREVIOUS multimeter circuits, like the recent "Checkameter" designs, have proved immensely popular with readers, in both the d-c and the ac-dc versions. However, we felt that a simpler and more compact design would have its appeal, particularly as there appear to be a fair number of meters available just now from disposals sources.

RANGES

The design provides for a single "ohms" range, voltage ranges of 10, 100 and 500, and current ranges of 1, 10, and 100 milliamps—seven ranges in all. It is quite an easy matter to modify any of these ranges to suit individual requirements, while the layout is so simple that no one should have any difficulty in adapting it to suit components which may be on hand.

The fundamental requirement for a multimeter of this type is a meter movement with a full-scale sensitivity of one milliamp. Meters of this type are available from all meter manufacturers fitted, if desired, with scales suitably calibrated in ohms, volts and milliamps.

One - milliamp movements have also been on sale from stores handling disposals, equipment, some of Australian, others of overseas manufacture. Generally speaking, Australian - made meters are the best proposition, if only because it is possible to contact the manufacturers for the supply of scales and shunts to suit. With other meters, you may or may not be able to obtain a suitable scale. If not, the alternatives are either to make do with whatever scale is already fitted, or to get to work with mapping pen and marking ink to draw a scale for yourself.

Meters less sensitive than one-milliamp full scale are of little use for a general purpose multimeter, no matter how accurate they may be, or how cheap. This applies particularly to the large number of five milliamp movements which enthusiasts are salvaging from junked transmitters and test gear. Though excellent for metering "ham" transmitters, and so on, they are insensitive as ohmmeters and, as a voltmeter, draw five milliamps full scale from the circuit under test.

THE METER

There is no alternative. If you want a sensitive multimeter, you must start off with a one-milliamp meter movement, whether it comes new from the manufacturer or turns up as an unexpected bargain.

Our own little multimeter is built around a standard 3in. round meter, and has a front panel of black bakelite measuring 4in. wide by 6½in. long. The meter is at the top, with a two-pole six-position range switch in the lower right-hand corner. Below the meter, and to the left, is the ohms adjustment potentiometer and three pin-jacks for insertion of test prods. Actually, these few components, plus five resistors and a torch cell made up the total complement of parts.

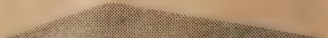
The operation of the circuit is quite conventional, but a few words of explanation may be appreciated by beginners. Taking the voltage ranges first, the test leads are plugged into the "C" jack and the one marked "V, mA." The selector switch would be rotated so that the contact is made, as required, with either the 10,000 ohm or the 0.1 or 0.5 meg. resistors.

THE CIRCUIT

The circuit is actually drawn as it appears when looking on the rear of the panel, so that the voltage positions are the three extreme clockwise settings. Looking on the front of the panel, the switch is on the right, as previously stated, and the voltage positions are the counter-clockwise settings.

Assuming the switch to be in the extreme position, the circuit is from the positive test lead, in the "V, mA" jack, through the 10,000 ohms resistor to the right-hand bank of the switch—still referring to the circuit diagram. From the switch, the current flows to the positive terminal of the meter, through the meter movement to the "C" pin jack and thence to the negative test lead.

If the voltage applied to the test leads happens to be 10 volts, a current of exactly one milliamp will



The finished meter is compact and has a good appearance.

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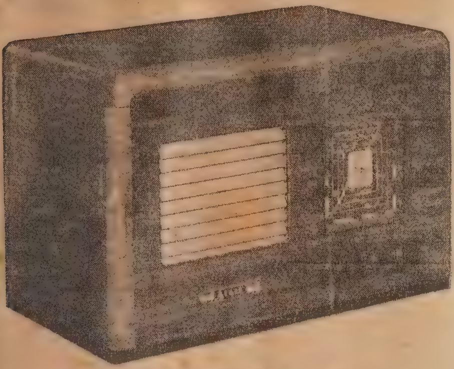

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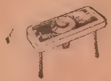

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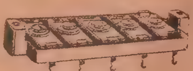
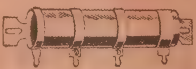
This standard trimmer is small and compact, and ideal for trimming coils, etc. Type CG15. 2 plate 1 0



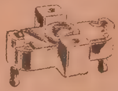
FIVE IN ONE TRIMMER

Five trimmers in one block, comprising four—2 plate trimmers and one—3 plate, or made to any specification, and an ideal unit for the small manufacturer. Type CG19 3 6



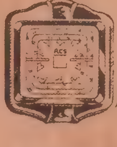
R.C.S. VOLTAGE DIVIDERS

Wound with oxidised nichrome wire on round bakelite formers 3¾in. x ¾in., complete with mounting legs.
VD25 15,000 ohms, 2 variable clips 5 6
VD 28 25,000 ohms, 2 variable clips 5 6



PADDING CONDENSERS

R.C.S. padding condensers are complete on a clear polysteryene base with 6 B.A. insert moulded in a centre to ensure perfect finish. Available in four standard capacities. Variations from standard made to special order.
P21 Padding Condenser 460 K.C. 2 6
P22 Padding Condenser 262 K.C. 3 0
P23 Padding Condenser 175 K.C. 3 0

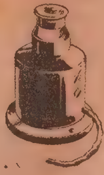


DIALS

This portable D/W kit dial has all parts supplied ready to assemble and has a glass scale with B/C and S/W bands clearly marked, finished in white with green background. The special walnut escutcheon is easy to fit and requires an aperture of 3in. x 3in. This dial can be edge lit and is suitable for use with II gang condensers on 1600 and 550 K.C. and 13-7 to 40 metres.
Type DA7 .... 9 0

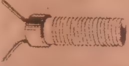
CENTRE TAPPED RESISTORS

10, 20, 30, 75, 100 and 200 ohms. 1 0



HEAVY DUTY LINE FILTER — Bakelite Case

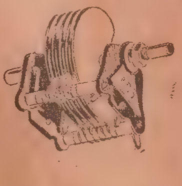
Generally our standard type LF20 line filter will eliminate noises caused by power mains—Feed backs or other electrical disturbances, in some cases however, a heavy duty line filter is required and our technicians have developed this component, which is housed in a bakelite case and complete with flex and plug.
LF21 3 amp without condensers 1 17 6

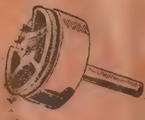


5 BAND TROLITUL SHORT WAVE COILS

These coils are the latest product of our factory, and the former after being moulded from polysterene is grooved in a lath, thus keeping the winding accurately spaced and providing perfect tracking.

Metres	Aerial	R.F.	Osc.	
10	H124	H125	H126	.. .. 4 6
20	H127	H128	H129	.. .. 4 6
40	H130	H131	H132	.. .. 4 6
80	H133	H134	H135	.. .. 4 6
B/C	H136	H137	H138	.. .. 5 6

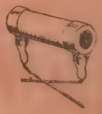




POTENTIOMETERS & RHEOSTATS

The R.C.S. volume control is constructed so as to cut off all volume, the main fittings are made from high grade nickel silver, and they are so manufactured as to be completely noiseless.

PT 40	6 ohm	25 amp	5 0
PT 38	10 ohm	25 amp	5 0
PT 39	20 ohm	25 amp	5 0
PT 34	30 ohm	25 amp	5 0
PT 46	400 ohm	50 M/A	5 0
PT 47	1000 ohm	35 M/A	5 0
PT 49	2500 ohm	30 M/A	5 0
PT 51	5000 ohm	30 M/A	5 0
PT 52	10,000 ohm	20 M/A	5 0



WIRE WOUND RESISTORS

Available in a complete range of O ohms to 10,000 ohms, variations from standard made to special order. Wire wound resistors are wound with highest grade nichrome, heavily protected and subject to test underload. Carrying capacity is always under-rated ensuring ability to carry specified load.
0 ohms to 1500 ohms, 100 M/A 1 0
1500 ohms to 2500 ohms 50 M/A 1 2
2500 ohms to 10,000 ohms 25 M/A 1 2

MIDGET VARIABLE CONDENSERS

These tiny compact components are the result of improved and new methods of manufacture, and are made in two types using trolitul supports thus guaranteeing practically no loss.

STAR TYPE WITH FACE SUPPORT ONLY—

	Max. Cap MMFD	Min. Cap MMFD	Plates	
CV34	10	3	2	.. 4 0
CV35	15	3	3	.. 4 3
CV36	25	3 5	4	.. 4 6
CV37	35	4	5	.. 4 9
CV38	50	4	7	.. 5 3
CV39	70	5	9	.. 5 10
CV40	100	6	14	.. 6 6

M.C. TYPE WITH FACE AND BACK SUPPORTS AND SUITABLE FOR GANGING—

	Max. Cap MMFD	Min. Cap MMFD	Plates	
CV41	10	3	2	.. 7 3
CV42	15	3	3	.. 7 9
CV43	25	3 5	4	.. 8 4
CV44	35	4	5	.. 9 0
CV45	50	4	7	.. 9 6
CV46	70	5	9	.. 10 0
CV47	100	6	14	.. 11 3

R.C.S. RADIO PTY. LTD.

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flow through the meter circuit and the meter will read full scale. A potential of five volts would cause it to read half scale and so on.

With the 0.1 meg. resistor in circuit, the meter will read full scale with 100 volts applied to the test prods and with 500 volts when the 0.5 meg. resistor is in circuit. It is thus delightfully easy to calculate the value of voltage "multiplier" resistors for a 1.0 milliamp meter movement. Simply multiply the desired voltage range by 1000 and call the resultant figure ohms. Actually you should subtract about 100 ohms for the resistance of the meter itself, but this is a comparatively minor point. More of this anon.

With the switch in the 1 milliamp position, the circuit is from the "V, mA" jack, straight through the right-hand section of the switch, through the meter movement and thence back to the "C" jack. Thus any test which causes a current to flow through the meter circuit will register directly on the meter face. Care must obviously be taken to see that the applied current does not exceed one milliamp, or the meter may be overloaded and damaged.

USE OF SHUNTS

To read a current greater than one milliamp, but less than 10 milliamps, the switch is rotated to the "10 mA" position and the appropriate shunt resistor is brought into circuit. The circuit is then from the "V, mA" pin jack, through the left-hand section of the switch, through the 10-milliamp shunt resistor to the "C" jack. There is an alternative path from the top end of the 10-milliamp shunt, through the right-hand section of the switch and the meter movement back to the "C" pin jack.

The 10-milliamp shunt must be arranged to have a d-c resistance equal to exactly one-ninth of the meter movement, the latter figure usually approximating 100 ohms. The current then divides inversely as the resistance, one-tenth part going through the meter movement, the other nine-tenths through the current shunt. If 10 milliamps is applied through the test prods, nine milliamps will flow through the shunt and one milliamp through the meter. The meter will thus read full scale and to all intents and purposes register in terms of 10 milliamps full scale.

SWITCHING

Similarly, the 100-milliamp shunt is made equal to one ninety-ninth of the meter resistance, so that it would approximate one ohm. For a 250 milliamp range, the current shunt would have to equal the meter resistance divided by 249.

If the shunts were to be switched straight across the meter, any slight resistance which the switch contacts may introduce would lead to error and this possibility is avoided by using a double-pole switch. The way it is wired puts the meter across the shunt only, and varying contact resistance on the left-hand section of the switch has no effect on the division of current and the resultant accuracy of reading. Varying contact resistance in the right-hand section of the switch is not likely to be serious, because it would be swamped by the 100-odd ohms resistance of the meter movement.

Finally, there is the matter of the ohms range, which involves the use of a third pin jack. To use the ohms scale, the meter leads must be plugged into the "C" and "ohms" jacks, and the selector switch left in any position other than for 10 or 100 milliamps.

Tracing the circuit through from the "C" jack, there is a direct connection to the negative terminal of the meter. Then through the meter movement, through a torch cell, one section of a 1000 ohm potentiometer, through a 1000 ohm fixed resistor back to the "ohms" jack.

When the test prods are shorted together, current flows through the circuit from the battery and the meter reads.

Adjustment of the 1000 ohm potentiometer will allow the meter to read exactly full scale with the test points shorted, this representing zero

(Continued on Page 64).

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HERE IS MY DIPLOMA SIR AND I HAVE MORE BUSINESS THAN I CAN HANDLE, ALREADY
GOOD BOY!
POP SAYS WE CAN GET MARRIED
OH! JACK, ISN'T IT WONDERFUL?

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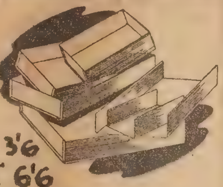

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13"×7"×2½"	7/6		
13"×10"×2½"	9/.		
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CUTS UP TO 3" DIAM

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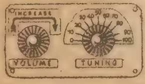

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PICTURE NEWS OF THE WORLD'S SKYWAYS

RAF "All-Weather"

BAD weather is not allowed to hold up flying in the RAF's new "all-weather" training policy.

Under this scheme, student pilots are being taught from the start of their career to appreciate that with instruments and equipment it is practicable to fly in all weathers — and they must be prepared to do so.

The Percival Prentice, which is the first trainer to be specially designed for use in this all-weather scheme, is the only machine of its type to be equipped with SBA (Standard Beam Approach), and amber-colored instrument-flying screens as well as VHF radio and full blind-flying panel.

The aircraft, which is designed to Air Ministry specification, is being built for the RAF as its standard basic trainer by the Percival Aircraft Company, Luton, England.

* * *

The Cyrodye

A SUCCESSFUL first flight has been made by the Fairey Gyrodyne, which incorporates an off-set power plant driving a normal VP tractor airscrew.

As a result of this arrangement, the Gyrodyne, which can take-off, climb and land as a helicopter, may be cruised as a gyroplane by obtaining its translatory thrust from the airscrew and its sustentation from the autogyratory motion of its rotor-blades.

* * *

8-Jet "Wing"

FIRST tests of the eight-jet YB-49 bomber at Muroc Field indicates that the huge Flying Wing is capable of setting new performance records for heavy aircraft.

The crew claims unusual climbing ability for the plane and take-off acceleration so rapid that the engines must sometimes be throttled back to avoid exceeding gear-down operations speed before the gear can be retracted.

* * *

Push or Pull?

MAJOR modification of later Consolidated Vultee B-36 bombers, which will make the plane's six engines and propellers tractors instead of pushers is being discussed by the US Air Force and Convair.

A new and more powerful development of the Pratt and Whitney Wasp Major 4360 engines figures in the proposed change, which is expected to increase speed of the big bombers very materially.

* * *

THE Gloster Aircraft Company is working on a new jet fighter powered by a single Nene engine. Company officials say the aircraft when completed will be one of the most powerful fighters yet built.

The world's largest flying-boat in commission, the Martin Mars, designated JRM-1 built by the Glen L. Martin Company, shown in flight. A versatile flying warehouse, the JRM has wide cargo doors large enough to load with ease such bulky items as 20-ton tanks, jeeps, &c. With a wing span of 200 feet the giant four-engined aircraft is the largest addition to the USA Naval Air Transport Service.

Grumman Jet

COMPLETION of the Grumman XF9F-2, Panther, marks the long awaited entry of Grumman Aircraft Corporation in the jet field.

With a speed approaching the 650 miles an hour mark and a ceiling above 45,000 feet, this new fighter is marked for quantity production as a standard United States Navy fighter.

Much of the high performance of the Panther results from the use of British Rolls-Royce Nene turbojet engines developing 5000 pounds static thrust and up to 5700 pounds of thrust with the use of water ejection equipment, which is installed on the XF9F-2.

The engine, designated J-42, will be produced by Pratt and Whitney, with the first engine, a J-42-P-2, scheduled for completion this month.

* * *

Skystreak altitude

DOUGLAS Aircraft Company's world speed record holder, the D-558 "Skystreak," is being overhauled for high-altitude tests that may put it in competition with the Bell XS-1 for a first attempt to go through the speed of sound.

Gene May, Douglas test pilot, recently pushed the Skystreak to an estimated 680 miles per hour at Muroc Field Army Air Base.

This was approximately 30 miles an hour faster than the official world speed record flown by Major Marion E. Carl on August 25 last year.

May reported, following the 680 miles per hour run, that the plane's behavior gave no indications of "adverse" compressibility.

Fast Flight

RECENTLY, a standard operational Meteor IV belonging to the RAF Central Fighter Establishment, and flown by Squadron-Leader James Lomas, DFC, covered the distance of 313.1 miles between Edinburgh and Bovington, North London, at an average speed of 617 mph.

The lapsed time of 30 minutes 25 seconds for this flight included take-off, climb and approach, while this Meteor, moreover, carried its full complement of military equipment, including armament and radio.

* * *

Jets and Radar

EXPERIMENTS with Lockheed P-80 jet fighters indicate that the highly-polished jets cannot be detected by long-range radar.

Most radar reflections from conventional aircraft come from the engines and propellers, not the fuselage.

To handle jet fighters, the US Air Forces have equipped their radar traffic control systems with special radar transfinder beacons that register blips on ground radarscopes.

Even at close range, a jet fighter blip is so small that it is obscured by the runway extension lines on the final approach scopes.

* * *

THE Martin AM-1 Mauler can carry three standard United States Navy aerial torpedoes, a total external load well over three tons. This is the heaviest load a single-engined aircraft has ever carried under operational conditions.

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R.F. Chokes	1/6
D.C. 2A Tuning Units B/C & S/W. 13 to 42 meters	36/-
I.C.62 S/W Aerial Coil. Iron Cored 13 to 42 meters	4/9
I.C.63 R/F Coil Iron Cored 13 to 42 meters	4/9
I.C.64 Osc. Coil. Iron Cored 13 to 42 meters	4/9
Z.C.59 Aerial Coil. Air Cored (13 to 42 meters)	2/10
Z.C.60 R.F. Coil. Air Cored (13 to 42 meters)	2/10
Z.C.61 Osc. Coil. Air Coiled (13 to 42 meters)	2/10
5 Plate Padder Cond. 455 KC.	2/6
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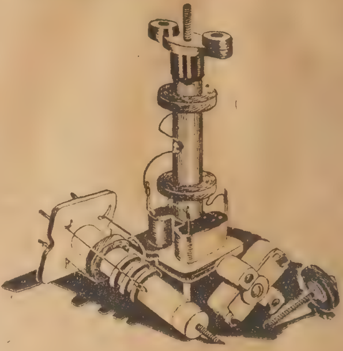

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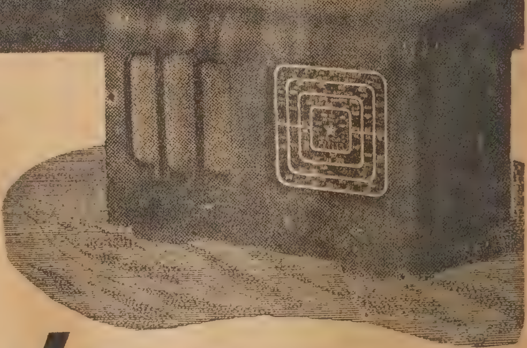

FEATURES TO TALK ABOUT!

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TWO U.S.A. FLY YOURSELF AIRCRAFT

A FOUR-SEATER, the Bonanza is of all-metal construction and has the unconventional butterfly tail that Beech pioneered. It has the highest speed of the four-place personal planes so far announced—184 miles an hour top speed and 175 miles an hour cruising speed on 70 per cent. of power.

The cabin itself is soundproofed, and in addition mufflers are fitted to reduce engine noise, and a quiet, slow-turning propeller is used.

Power comes from a 168-horsepower Continental motor. The propeller is of the controllable-pitch type.

The Bonanza's V-shaped or butterfly tail makes possible simplified structure. The movable surfaces of this tail unit act as elevators or rudders. When moved in unison (both up or both down) they do the work of the conventional elevator; but when one is raised and the other lowered, the effect is to swing the plane as a rudder does.

MANOEUVRABLE

The butterfly tail is said to give the Bonanza excellent manoeuvrability.

Tricycle-type landing gear is fitted, the full-swivelling nosewheel being steered by brakes.

Full flight instruments are provided. Other equipment includes navigation and landing lights, two-way radio, windshield de-icers, marker-beacon receiving and homing loop.

Payload with full tanks is 780lb Maximum range at cruising speed at 10,000ft. is 750 miles.

Dimensions of the Bonanza are: Wingspan 32ft. 10in., length 25ft. 2in., and height 6ft. 6in.

The Culver V is a trim little two-seater of all-wood construction. It features the "Simpli-Fly" control — actually the old-fashioned trim-tab added to a flap which is linked with a simple position-indicating instrument on the pilot's control panel.

SPECIAL CONTROL

The pilot turns the big wheel mounted between his and the passenger's seat until the Simpli-Fly dial reads "take-off," "landing," "approach," or whatever manoeuvre is intended. The plane itself practically does the rest.

Fully-retracting tricycle gear is fitted. Gear and brakes are sturdy enough to permit normal 60-mile-an-hour landings on small airfields.

The "V" has a steep landing approach at about 80 miles an hour.

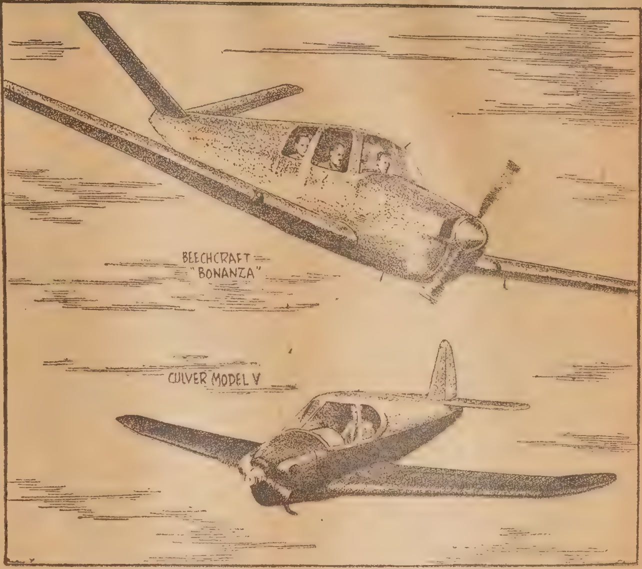
Bent-up wingtips improve general flight stability. Anti-stall strips are built into the wings' centre sections.

Pilots who have flown the Culver V declare that the plane is extremely difficult to stall, that there is excellent aileron control at all times, and that manoeuvrability is good. The plane is easy to trim for cruising.

Fuel capacity is 32 gallons, giving a range of about 700 miles. Cruising speed is said to be from 115 to 130 miles an hour. Top speed is above 130 miles an hour. Weight empty is 1040lb., and gross weight 1600lb.

Power comes from an 85-horsepower Continental motor, driving a two-position wooden propeller.

Dimensions of the Culver V are: Wingspan 29ft., length 20ft. 6in., and height 6ft. 9in.



Two American light planes specially designed for the private flier that are now making names for themselves are Beech Corporation's "Bonanza" and Culver Aircraft Corporation's "Model V". Both are low-wing monoplanes, and each features a number of interesting design points.

Engineering Feats of the Animals

(Continued from Page 9)

sion between three adjacent cells on the opposite side.

The comb is so constructed that there is the greatest economy in space, material and labor, and it has been proved that the angles which obtains within the comb is mathematically the best. There is a marvellous accuracy in the construction, and many disputes have taken place as to whether the bee builds the comb purely from instinct or whether it knows what it is doing It is not likely that this argument will ever be settled, as the little bees won't say.

It seems that most of man's constructional and manufacturing ideas have been anticipated by our animal, insect and bird friends. Think of the wonderful woven nests of many birds. The silk-lined cocoons of caterpillars so tough that the material cannot be torn by the hands, so delicate that it is shiny smooth. We have all seen these cocoons hanging from the limbs of trees.

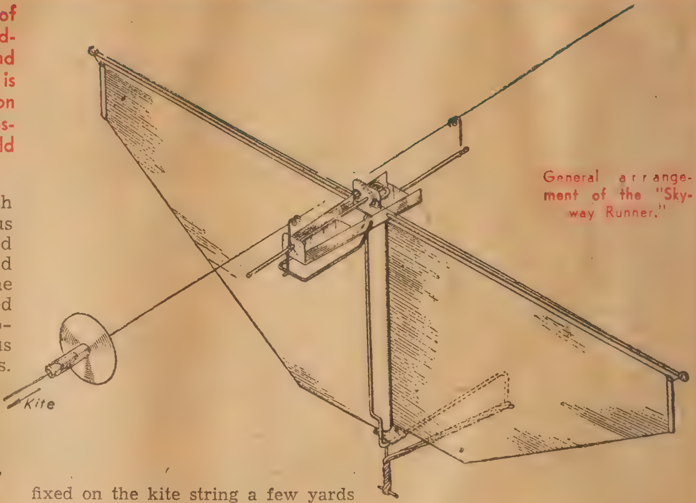
There are fish which have headlights to lighten the way in the inky depths of the ocean. Fish that have rods and fishing lines with bait complete dangling from their backs. There is an insect that eats its way through steel railway lines by a secretion of acid. Eels which generate electricity. Moths and worms which generate their own phosphorescent light. Plants which manufacture chemicals in a manner which cannot be duplicated by any process known to man.

We owe a lot to the creatures of lower nature, for it is there that we have often found the secrets which have enabled man to progress to his present state. No doubt the future will owe as much when more of Nature's secrets have been wrested from the present holders —the animals, birds, insects, fish and plants.

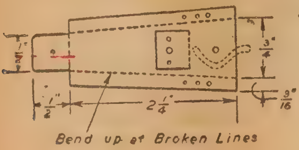
MAKE YOURSELF A SKYWAY RUNNER

To kite-flying enthusiasts the idea of the "messenger," the circle of cardboard slipped on to the string and gradually blown up to the kite, is well known. This led to the question being asked if it would not be possible to make something that would not only go up but also return.

THIS started a discussion with a few friends and various ideas were forthcoming. It ended with a little experimenting, and eventually the writer evolved the following design that worked very well. The following description and drawings of the apparatus may be of interest to other readers.



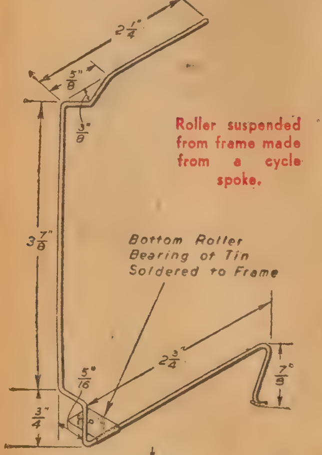
General arrangement of the "Skyway Runner."


5/8"
1/2"
2 1/4"
3/4"
9/16"
Bend up at Broken Lines

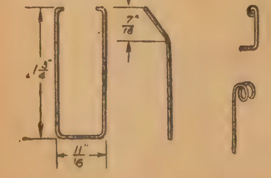
The runner platform before being bent to shape.

The main idea of this "Skyway Runner," as shown in Fig. 1, consists in the provision of two sails or planes which, on reaching a stop fixed on the kite string a few yards from the kite, roll up tightly and the weight of the runner is sufficient for it to slide down the string.

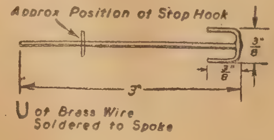
The materials required are a few cycle spokes, some tin, brass wire about 18 gauge, 4½in. of ¼in. round dowelling, greaseproof or similar paper, thread and elastic bands or model aeroplane motor rubber.


2 1/4"
5/8"
3/8"
3 7/8"
Bottom Roller Bearing of Tin Soldered to Frame
2 3/4"
5/16"
7/8"
3/4"

Roller suspended from frame made from a cycle spoke.


7/16"
1 3/4"
11/16"

Parachute carrier and striker bar stop-hook.


Approx Position of Stop Hook
3/8"
3/8"
3"
U of Brass Wire Soldered to Spoke

The striker bar.

To construct, first mark out a piece of tin to form the runner platform (Fig. 2). The holes can be drilled or punched to approximate size and cut to shape. Chisel cut the centre on three sides, and bend up on the broken lines, the centre part front end, and sides. A spot of solder at the corners will strengthen it. Bend a cycle spoke for the roller support frame (Fig. 3). This is soldered to the underside of the runner platform, as shown by dotted lines. The bottom roller bearing of tin is soldered to the roller support. The wood roller (Fig. 4) is next fitted, using a tack at the top and a piece of spoke with cross piece of wire soldered on in the bottom. Make sure the roller revolves freely. The striker bar (Fig. 5) is made of a spoke 3in. long, with a U-shaped piece of brass wire soldered to one end and made a sliding fit in the three holes in the centre piece of the runner platform. The striker bar stop hook is soldered to the striker bar about 7-8in. from the end. This stop hook can be used in conjunction with a parachute carrier (Fig. 6). The runner

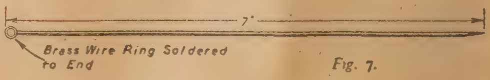

7"
Brass Wire Ring Soldered to End

Fig. 7.

Sail arm.

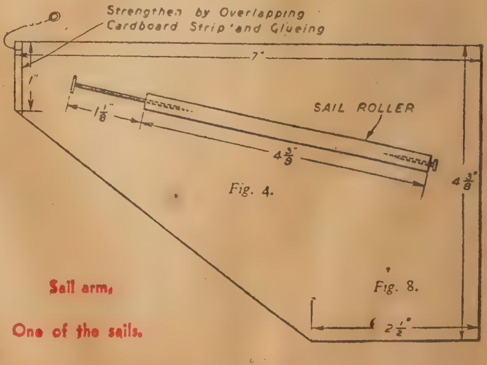

Strengthen by Overlapping Cardboard Strip and Glueing
7"
1"
1 1/8"
SAIL ROLLER
4 3/8"
4 3/8"
Fig. 4.
2 1/2"

Fig. 8.

One of the sails.

loops can now be soldered to the front of the runner platform and the end of the roller support frame top.

FITTING THE SAILS

The two sail arms (Fig. 7) are each made of spoke 7in. long with a small wire ring—1-8in. hole—soldered at one end, the other end being square tapered. The two paper sails are cut and glued to the roller so that they are equal each side. The ends of the sails are strengthened by glueing over a thin strip of cardboard (Fig. 8). Tie a 9in. piece of thread to the end of each sail. With the sails rolled up, fit a rubber band round one end of the cross piece at the bottom of the roller and, giving it one turn for tension and direction, slip the other end of the rubber band over the end of the roller support frame, as in Fig. 1. Fit in the sail arms by putting the tapered ends through large holes, just aft of the runner platform centre, and press the point into the smaller hole on the opposite side. Pull striker bar forward and have two small brass rings ready. Pull out the sails with the thread through the ring at the end of the sail arm and tie to a ring at just the right length so that it engages on the nearest pin of the U-piece on the striker bar. Do the same with the opposite sail. When the striker bar is pushed back the sail threads are released and the tensioned roller will fold the sails up tightly. A parachute carrier can be fitted, if desired, and this is hinged in the holes just forward of the centre piece, being held up by the striker bar stop hook when the striker bar is in the forward position. The runner stop is made with a disc of stiff tin or similar metal about 1½in. diameter with a hole in the centre to take a piece of ¼in. brass or copper tube. Solder the disc near one end of the tube.

TO OPERATE

The kite string is threaded through the runner stop from the disc end, and is held about 3 or 4 yards from the kite by plugging the string in the tube with a matchstick.

When the kite is flying steady, put the "Skyway Runner" on the string. Pull the striker bar forward. Take the two sail rings and, pulling them to the centre, hook them on the releasing points of the striker bar.

Push the runner up the kite string a few yards and the air currents will start it running up towards the kite.

When it reaches the stop the striker bar will release the sail cords, allowing the sails to be furled. The runner will then return down the string. When a parachute is put in the hinged holder it is dropped when the striker bar is pushed back on reaching the stop. It will be noticed that the runner attains a good speed on its return journey and, unless checked, is likely to give the hand holding the kite string a nasty knock.

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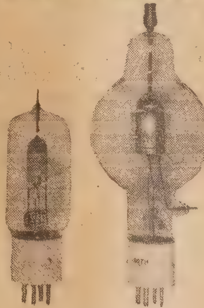
BARGAIN
PRICES ★
THIS MONTH'S SPECIALS



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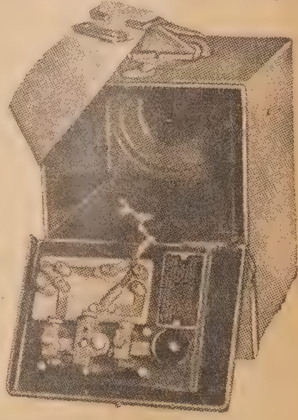

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SHORT WAVE NOTES BY RAY SIMPSON

TASMAN YACHT RACE CONTACTS

VJLJ KURREWA III

The recent Tasman Yacht Race proved particularly interesting to short wave listeners due to the fact that a number of the yachts were equipped with radio. However, according to newspaper reports at the conclusion of the race, the radio did not appear to have been too successful. Very few, if any contacts were made between the yachts themselves, and signals from the yachts were not heard consistently by shore stations.

AT our location we first heard the Kurrewa III on the Saturday before that yacht arrived in Sydney. The call letters of this one was VJLJ, and it could be followed reasonably well in both speech and Morse when in contact with VIS. The frequency in use at the time was 6.28mc. which, of course, is rather noisy at any time, but reception was possible most of the time.

The only other signals heard were from an unknown yacht which we think may have been the Peer Gynt, but no call letters were heard. Perhaps some other listeners may have logged some of the other entrants, but at the time of writing we have had no reports from anyone having heard them. We hope to obtain verification from VJLJ as it will be quite an interesting one.

DX CONTEST

At time of writing these notes the majority of the Australian entries for the contest have been received but we are allowing a few more days for those from New Zealand to arrive. It seems that a number of listeners who signified their intention of entering the contest consider that they have not received a sufficient number of verifications to justify submitting their entries.

Admittedly, some stations are very tardy in replying, but this applies to all contestants equally and is something which is all in the luck of the game. In next month's issue we will publish the winners' names in both sections and comment on some of the best verifications received.

AUSTRALIA.—We notice in a Press item that the Metropolitan Water, Sewerage and Drainage Board in Sydney plan to equip their service cars with radio to enable them to give immediate assistance to the board's customers in a similar manner to the system operated by the County Council Electricity Department. The frequency is not known, but someone will come across them we know very soon after they take the air. There are quite a number of stations operating around 4 and 5mc. which use the call prefix of VL and we think that these may be some of the various Forestry mobile stations which are operating in various parts of the country.

ANTARCTICA.—The DX session from Radio Australia advises that very weak signals have been heard from the Heard Island base station of the Australian Research Expedition to Antarctica. These signals were logged by one of the RAAF stations in Perth, so listeners should keep a lookout for them during the next few weeks. The call letters and frequencies of these stations are as follows: VJH 9.94 mc., VJH2 12.255mc., VJH3 15.845mc, and VJH4 19.255mc.

The base station which will be located on Macquarie Island will use the same frequencies as given above but the call letters will be VJM, VJM2, VJM3 and VJM4. Whether these stations will verify or not is rather doubtful at present, but we think they may do so at a later date.

YEMEN.—To most listeners this will certainly be a new country, as so far we have not heard of any Australian listener logging a station reported by Mr. Herbert Bluman to Radio Australia. This new station is situated at Sanaa which is the capital of this small kingdom and it operates on 7.385mc. with programmes in Arabic from 11.30 pm till around 3.30 am. Another station reported by the same observer is one located at Manama on Bahrein Island in the Persian Gulf. This one operates on approximately 7.7 mc. and on the air from 1 am till 2.30 am. The programme consists mainly of very old American and French recordings, announcements are in Arabic and Persian, but before closing down, station identification is given in French.

VHF STATIONS.—We have recently received a very interesting letter from a well-known Victorian listener, Mr. Alan Graham, of Rosanna. The report he sent is truly a remarkable one and we feel sure without equal by any other listener in this country. During the past two years Mr. Graham has concentrated on the VHF bands and has used a 15-tube home-constructed receiver using plug in coils and tuning from 22 to 100mc.

Using this receiver and listening entirely between 30.1 and 39.9mc., he has logged in the past 16 months no less than 360 American VHF stations, of which at least 50 per cent. were on FM. These stations include Police, Fire Department, Forestry, and other special emergency services stations. Reports have been sent to many of these stations and a large number of verifications have been received. In most cases his report was the first received from Australia. A total of 42 verifications from FM stations have been received in his total of 98 which have been obtained from 1937 to the present time.

Short Wave Notes for the April issue are due on March 6th. For the May issue they are due on April 9th. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, N.S.W.

The highest frequency verified is an FM police station on 39.9mc. His actual list of stations received is really very impressive, but unfortunately space does not allow us to print it. Any listener who has a receiver which will tune to to these frequencies should have a very interesting time, but we doubt if any will have the success which Alan Graham has had. Further reports from this very capable listener will be looked forward to with great interest.

MYSORE.—In a recent letter from Rex Gillett we learn of some details concerning station VU7MC which Rex has recently verified. This station is owned by the Government of Mysore and the address is Akash Vani Broadcasting Station, Mysore, India. It has three transmissions which are given on 968kc. and 6.065mc. from 11.30 am to 1.40 pm, 6.30 pm to 7.40 pm, and 10 pm to 2.40 am. Present power is 300 watts on the short-wave channel, but plans are being made to increase the power to 5kw. It is hoped this transmitter will be installed early in 1948. The American station on 6.06mc. makes it very hard to hear VU7MC, but by careful listening you may hear the [illegible] in English given at 10.30 pm.

RADIO BRAZIL CONFIRMS

PR13, BRAZIL.—About the middle of last year we reported having heard the Brazilian station PR13 in Belo Horizonte. After rather a long delay we have received a very nice letter by registered post confirming our reception of this station on 5995kc. The letter was written in Portuguese, but there was no difficulty in translating it as it is very similar to Spanish. This station is known as "Radio Inconfidencia" and the address is given as Edificio da Feira Permanente de Amostras, 1 Andar, Belo Horizonte, Brazil. The letter was signed by the director of the station who has the very colorful name of Ney Octaviani Bernis. This station has not been heard for some months now.

YDC BATAVIA.—Many readers have complained that they had not received verifications from Radio Batavia, but at last they seem to be coming through, as Art Cushen has received his for YDD2, PLY, PLS, PLO, and PLU, and the writer has just received his for YDA2, YDB2, YDB4 and YDC. In addition to a letter from the gentleman in charge of the English section, Mr. P. R. Hill, a rather attractive card was sent which shows a view of a volcano with two radio masts with lines radiating from one of them.

On the reverse side are the verification details in Dutch, Malay and English. Mr. Hill states that pressure of work and staff shortages have caused the delay. Other readers can now look forward to receiving their cards in the near future.

OAX4J, PERU.—Mr. Ern Moore kindly sent down his letter of verification for OAX4J, which he recently received in answer to a report of last June. This station, which is located in Lima and operates on 9330kc., has the title of "Radio Colonial" and letter confirming report was written in Spanish. This station can still be heard on Sunday afternoons and occasionally around 11 pm. In the old days it used to send out a rather handsome card verifying reports, but the station now seems to have changed hands and adopted a letter instead of a card.

XMPA, CHINA.—From both Mr. Krumbeck and Mr. Cushen we have received word of the verifications they have received from station XMPA which is the Military Radio service Station of the Chinese National Defence Department in China. Their verification takes the form of a letter signed by the director Mr. Fu Hwa Hsu and states that it uses 1000 watts on a frequency of 12.22mc.. The address is 10 Snake Mountain, Hanchungman, Nanking, and times on the air, 9 am to 10 am, 2 pm to 4 pm, and 7.30 pm to 12.30 am. Mr. Major, of Western Australia, also reports a veri from this Chinese station, so others who have written can look forward to hearing from them in the future.

USS IOWA.—Ship verifications always have an attraction all their own. The writer was therefore very pleased recently when a verification for reception of the USS Iowa came along confirming a report on its 9.67mc. signals last March.

The letter which was signed by Commander H. H. Holton, the Officer in Charge of the Radio Television Section advised us that at the time of our reception, the ship was carrying out manoeuvres off the Southern Californian Coast. The letter also contained verification of our reception of WAVE aboard the Mt. Olympus, but we had already obtained this one direct from the ship's radio officer some time previously.

NEW STATION LOGGINGS

PHILIPPINE ISLANDS.—The Voice of the United States of America station which has been operating from Manila on 11840kc. for some months now has made a change in frequency.

As from February 1 it has moved to 11890kc. where it is heard at about the same strength as on the old channel. In addition to the new frequency in the 25 metre band it has also been heard n the 19 metre band on 15330kc. relaying he United Nations programme in parallel with KRHO and some of the other USA stations.

Strength of signal in this transmission s very poor at our location. This new outlet was first brought to our notice by Master Ramon Rooke, of Manly, NSW, and he is to be congratulated on findng it so soon.

It is interesting to note that the Manila tation KZFM, which has been operating on about 11900kc. for some time now, has also changed frequency and can now be ound on 11880kc. where it is heard very nuch clearer. This station announces as he "People's Station," but so far we ave not heard of any one receiving a erification.

Still another new station in the Philipines is the new one on 6100kc. located in Cebu and which has the call letters KZBU. This station was heard by the writer or some time and call letters could not e identified, but Rex Gillett came to the escue and advised that it was KZBU. ince that time we have heard it suggested it is KZPU, but we rather agree vith Rex that it is the former.

KOREA.—In last month's issue we reorted a new station located in Korea and perating on 9430kc. with the call of KAO. Since that time, however, we ave heard what appears to be the same tation now using 7930kc. and giving the all of XLKA. About every 15 minutes r so it announces in English, "This is he Korean Broadcasting Service." It s assumed that this station is located n the capital city, Seoul, and we have ent a report to that address. Our hanks are due to quite a number of eaders who have reported reception of his station which can be logged any ight around 9 pm.

COLOMBIA.—Still another station which as mentioned in last month's notes is JAP located in Cartagena in Colombia. is the station heard operating on about 05kc. around 7 am on occasional morngs. Although HJAP is supposed to be n 9897kc. we have definitely identified as the one on 9905kc. This one is never ery loud, but as it is on a part of the and widely separated from other stations, o difficulty should be experienced in entifying it when reception is favorle. Best time to listen is around 6.30 n, when it is quite often carrying the escription of some sporting events.

EL SALVADOR.—The reception of ations in this country is rarely if ever ported in Australia and the only one e writer has ever heard and verified YSD on 7894kc. It was very pleasing erefore to hear from Mr. Ern Moore, Brisbane, that he had logged YSUA 6255kc. This station is located in e capital city, San Salvador, and uses e slogan, "Radio Mil Cincuenta."

Mr. Moore heard this elusive Central nerican on New Year's Day around 6 n. Two other Central Americans heard the same day were the Guatemalans GBC on 6670kc. located in Mazatenango, d TGLA on 6295kc. which transmits om the capital, Guatemala City. Altother Ern had a great time with the tin Americans on New Year's Day.

CANADA.—Since the Canadian Broadsting Corporation inaugurated their gular transmissions to Australia and w Zealand they have become very pular with listeners in these countries the signals have been consistently od. We now hear from Arthur Cushen an additional service recently opened m the CBC, which is directed to the ctic. They began operations on Febru 1, and on that day they were using new station CKOB on 6090kc. in rallel with CKLO on 9630kc. Times the air with this new session are m 2.10 pm till 3.5 pm on Sundays only at the time of writing we have not d an opportunity of trying to log them.

STH. AFRICAN AIR FORCE STATION

VERIFICATION FROM ZRB

If readers will refer to our January issue they will see a paragraph giving details of the South African Air Force station which had commenced operations a few weeks previously. As mentioned in that issue we had heard a station which we felt certain was ZRB and which we had sent a report to.

WE were therefore very pleased to receive an air letter a few weeks later confirming the fact that the station we had heard on 7445kc. had actually been ZRB. As this station does not appear to have been heard very extensively we are giving their verification in full:—

Telecommunications Training and Development Centre,
Air Force Station Waterkloof,
P.O. Odonata, via Pretoria, South Africa.

5th January, 1948.

We are in receipt of your letter dated 24th November, 1947, and must apologise for the lengthy delay. Due to the shortage of typists all letters from our listeners have not as yet been answered.

We found your letter most interesting and take the opportunity of letting you know that we are now broadcasting on a frequency of 9110 kilocycles. We are classed as Aeronautical Radio Station and run by members of the Air Force for the Air Force.

Your report is the one and only we have so far received from any overseas country and we can definitely say that you have scored a most decided first. We will send you our ZRB verification card as soon as we receive them from the printers.

We have as yet been acting as a test station and hope to go on the air officially sometime in the near future. We would appreciate it very much indeed if you would at some time in the future let us have another report of ZRB. We are only using the frequency mentioned above and think it will possibly be clearer than the reception on 7445kc.

Please let us hear from you again and you are assured of a prompt answer.

Yours faithfully,
Jackie Petherbridge.
Announcer, ZRB.

Naturally we prize this verification very much, as it is certainly unique and as readers will see from it, this station is anxious to receive further reports on their transmissions.

As a matter of interest we have done quite a bit of listening on 9110kc. in an attempt to log it on this new channel, but the best we can hear is a very faint whistle with no sign of modulation. On a favorable occasion, however, it may be possible to tune it in on this frequency or alternatively on another channel, 6210kc. which was announced in a recent session from Radio Australia.

The writer will be particularly pleased to hear from any listener who is successful in logging ZRB on either of the above mentioned frequencies.

SOME VERIFICATIONS FROM READERS

IN order to save space, verifications from Australian and U.S.A. stations will no longer be shown and readers should wait until they have a minimum of 12 veries before sending in their list. A maximum of 20 verifications a month can be shown for each listener.

Mr. C. W. Jones: EPB, ZBW3, XGOY, YHN, VUD10, ZAA, HER5, KZPI, PCJ, ZFY, XGOA, XEWW, TAP, SDB2, HCJB, HS8PD, Leipzig, Johannesburg, Omduran, Warsaw.

Mr. M. Krumbeck: ZL2-3-4, HCJB, Rangoon, Singapore 21.72mc, Manila, XXMPA, VUM2 4.92mc, WLKS 6.105mc, HCJB, 15.11mc, Paris 11.84mc.

Mr. W. Milne: CBLX, CR7BV, CFRX, CBRX, Hamburg, HE17, HER6, FZI, CNR3, XLRA, HCJB, Paris, NAVE, Seac.

Mr. A. Cushen: CE622, CE1173, CE1180, LRX1, OAX4J, OAX4W/V, XMPA, PGD, PHI, PCJ, OIXI-2-4-5, Luxembourg 9.527mc 15.35mc, Singapore 9.69mc, 21.72mc. ZJM4-6-7.

Miss D. Sanderson: Capetown 5.88mc, Johannesburg 4.96mc, Singapore 6.77mc, 11.735mc, 15.3mc, ZL2-3-4, Benghazi 11.85mc, Madrid 9.38mc, EPB.

Mr. R. Block: SPB, Singapore 9.69mc, HP5A, WXFG, LRM, FZI, ZQP, WLKS, CE1190, TGWA, PRL7, Luxembourg 6.09mc.

Mr. R. Gillett. LKJ, LKV, (1st report from Australia), LLG, CXA19, H12T, LRM, ZPA5, VU7MC, EQB, HJDE, CE1190, ZOY Tabriz, 11.96mc, 12.18mc, CRERX, CHOL, XGOY, ZL2-3-4.

Mr. E. Moore: OAX4J, WLKS, HER3-4-5, HEU6, Rome 9.63mc, 11.81mc, ZQP, Capetown 5.88mc, PCJ 9.59mc 11.73mc.

Mr. F. N. Hymus: HCJB, HER5, XGOY, HS8PD, VUD7, VUM2, XGOA, SEAC, Hanoi, Singapore, ZL2-3.

Master R. Rooke: HEI5, CHLS, XGOA, HEU6, HCJB, PCJ, CHOL, Singapore, Kuala Lumpur, Noumea, Saigon, VUD5/7.

Our Own Listening Post: — SBO, SDB2, Baden—Baden, VPO3 (1st report from Australia), ZOY 7.3mc, XLRA, Luxembourg 9.527mc, 1535mc, LLN 17.185mc (1st report from Australia), Manila 11.84mc, (1st report from Australia), XECC (1st report from Australia), U.S.S. "Iowa" 9.67mc, ZRB, 7.445mc (1st report from Australia), PRI3, VP4RD, CR6RL, CR6RN, XURA, XMAG, YDA2.

NEW STATION LOGGIMGS

Call	Kc	Metres	Location.	Time Heard.
YV5RY	4725	63.49	Caracas, Venezuela.	9.0 pm
HJEX	4865	61.66	Cali., Colombia.	9.0 pm
CKOB	6090	49.26	Montreal, P.Q., Canada.	3.0 pm
KZBU	6100	49.18	Cebu, Philippine Is.	9.0 pm
VJLJ	6280	47.77	Yacht, "Kurrewa III"	7.0 pm
ZRB	7445	40.30	Waterkloof, South Africa.	2.0 am
XLKA	7930	37.83	Seoul, Korea.	9.0 pm
HJAP	9905	30.29	Cartagena, Colombia.	7.0 am
VLC3	11760	25.51	Shepparton, Vic.	1.0 am
B.F.E.B.S.	11765	25.50	Singapore, Malaya.	9.0 pm
KZFM	11880	25.25	Manila, Philippine Is.	9.0 pm
Manila	11890	25.23	Manila, Philippine Is.	7.0 pm
Manila	15330	19.57	Manila, Philippine Is.	6.0 pm
SEAC	17750	16.90	Colombo, Ceylon.	9.0 pm

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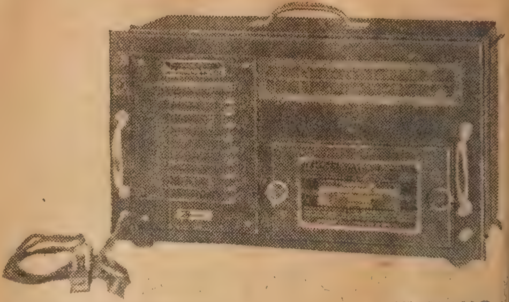

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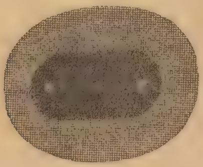

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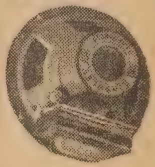

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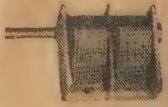

Kingsley as illustrated	21/
F.N. 2-Gang	19/
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BILL MOORE'S AMATEUR NOTES

The Wyatt Earp, of the Australian Antarctic Expedition, which left Melbourne early in February will carry radio equipment to communicate with amateur stations. The 7 and 14 MC bands will be used, crystal frequencies being 7019, 7027 and 7186 kcs. and double those frequencies in the 14 MC band. The special callsign to be used will be VK1AA and the equipment, consisting of a Type 3 Mark 2 transceiver, has been provided by the Wireless Institute of Australia.

QSL cards should be sent to Bill Mitchell VK3UM Federal secretary of the WIA, who will arrange the necessary forwarding.

The first VKI will provide an interesting contact for many Australians.

In special sessions news of amateur and Institute activities is broadcast over official DIA stations. Each division runs its own broadcast for its members. Call signs and frequencies are as listed below. VK2WI. Sundays—1100 hours, EAST 7190kc, 2000 hrs. EAST 50.4mc.

VK3WI. Sundays—1130 hours, EAST, 7196kc.

VK4WI. Sundays—0900 hours on 7100kc, 14358kc, and 52.4mc, simultaneously.

VK5WI. Sundays—1000 hours, SAST, 7195kc.

VK6WI. Sundays—0930 hours. WAST, 7168kc.

VK7WI. 2nd and 4th Sundays, 1030 hours, EAST, 7174kc.

Amateurs and listeners should keep a check on broadcasts to hear the latest in amateur affairs.

OPERATING

THERE is quite a lot of confusion as to the correct signals used today. The greatest amount from the different interpretations placed on them by the various services. After a lot of investigation the ARRL recommends the following uses.

AR—to be used after a call to a specific station before contact is established, and also after the end of each radiogram (not often applicable here).

K—CQ calls should be concluded with the signal K, also used at the end of each transmission during a contact.. It is also an invitation for anyone else to call and break in.

KN—A new ending signal which is to be used at the end of each transmission during a contact and denotes that only the specific station being worked or called should answer. It's really a keep out signal to other stations.

SK—This signal is used only at the conclusion of a QSO, and used only once by each station when they make their final transmission. Do not make another transmission after SK has been sent. that is to the station being worked. It should be noted that SK precedes the signing of the call; ie, SK VK2AAA de VK2ZZZ. No signal should be transmitted after the calls, unless you are closing, and the appropriate CL can be sent.

The four signals should be used singly and never two together. Each has its specific job and the use of each as listed above would help when one is tuning the band. When one hears AR, you know the station is calling someone and not CQ, and so you can reason on!

GET YOUR TICKET !

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DO YOU LISTEN TO VK3WI?

"Tune in on 7196 KC's at 11.30 every Sunday morning for W.I.A. activities. (Victorian Division)."

THROUGH January and early February, 6MX was rather quiet, if compared with December; however on a number of occasions the band opened for interstate work and for NZ. The best day for NZ seemed to be Saturday 31st, Jan., when VK2LY contacted 3ZL stations. VK2NO and 2WJ in Sydney also broke through. The first week in February saw the band open to VK3 and VK5 from VK2 and from VK4 to VK3, VK5, and VK7. On Wednesday, 4th February, VK3BQ, 3RR, 3US, 3HZ and 7XL were all S8 to S9 in Brisbane and 3VL, 3GE, 3PG, 3UU, 5GF, and 5GL were all logged in Bundaberg.

VK4LN and VK4HD have opened a 6MX link between Gympie and Budrum. The Sydney-Canberra link between VK2JU and VK2GU is open on most occasions and prolonged tests have been carried out. Signals running between S9 and a complete fadeout on occasions. 2GU using an 8JK beam and 2JU three elements both horizontal.

VK2ALU using 20 watts has also contacted 2GU and most Sydney stations hear him at good strength.

2LY of Katoomba has observed 2GU building up from S1 to S9 plus for a second or so at irregular intervals, apparently reflections from ionized trails of meteors a phenomenon observed overseas. 2ADX of Maitland listens every night except Tuesday at 1845 hours EAST on 7mc for anyone requiring tests on 166mcs. He transmits at 1900 hours on 166msc, using 4 elements vertical.

UNLICENSED TRANSMITTERS

IN recent weeks there seems to be an influx of "Pirates" into our amateur bands.

Quite a number of NSW stations have had their calls used illegally,, including VK2ADX, 2GS, 2FH, 2FF, and 2QA. The latter had the doubtful honor of answering a CQ by a pirate using VK2QA for a call.

It was generally anticipated there would be an increase of "Pirates" after the release of disposals transmitters. Such however was not the case up to quite recently.

It is in the interests of all amateurs that they should do everything in their power to kerb the activities of unlicensed transmitters. It may be your call they will use next and all information concerning "Pirates" should be sent on to the authorities.

FEDERAL W.I.A. NEWS

A STEP that will greatly assist the governing of the Institute federally has been agreed upon. In the future the Federal Executive of WIA for the following year will be elected by the respective division before the Federal Convention each year. Previously members of the Federal Executive were elected after the convention.

The change allows all elected members to attend the convention at last as observers and obtain first-hand information on the convention proceedings, and as it is at these conventions Federal policy is moulded the information should be invaluable in their work.

It is proposed to set up an awards committee to handle all applications for the WIA's DX Century Club. The committee will consist of the Federal QSL officer, Federal Traffic manager and the Federal secretary.

Cards then will be sent direct to the Federal Executive in Melbourne and not to State divisions as at present. The change should greatly assist in the correct listing of applications.

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The "Coronet"

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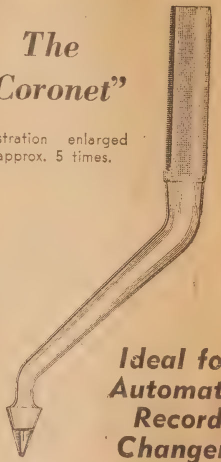

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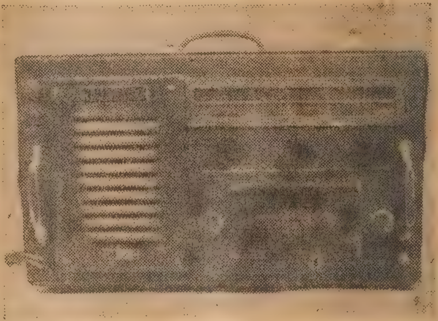

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OFF THE RECORD — NEWS & REVIEWS

Two vastly different English composers' works are presented in the list this month. They are those of William Walton and Vaughan Williams. They are, moreover, particulary representative of each composer.

By JOHN MOYLE

WILLIAM PRIMROSE, Violist, and Philarmonia Orchestra conducted by William alton—"Concerto for Viola and Orchesa" (Walton). HMV ED.559/61.

Walton is always brilliant, always cometent, always clever. Even in this conerto, he is more occupied with manner ather than content. There is some lack uniformity and sense of a well coneived whole, rather as though he had ollected and combined some of his ketches into a concerto, a series of inor works instead of a single big one.

Against this there is much splendid nd successful writing. Apart from its nportance to viola music, it is fine nough to be important in itself. Don't orry if you are somewhat bewildered n first hearing. You will come to admire fine work, if not a great one.

CINCINNATI SYMPHONY ORCHESRA. Conducted by Eugene Goossens—London Symphony" (Vaughan Williams) parts). LONDON SYMPHONY ORHESTRA. Conducted by Eugene Goosns—"Farandole from Arlesienne Suite o. 2" (Bizet). HMV ED.554/8.

'm inclined to class this as the best l-round symphony of Vaughan Williams. is exquisitely written—its slow movement is a gracious blend of harmony nd quiet, with those characteristic proessions so beloved by the composer.

It is in fact a rhapsodical programme ymphony about London, commencing ith dawn over the city, most beautifully layed, and ending with sleep once more, omplete with a muffled Big Ben, by no eans out of place or an intrusion on ought.

Between these two moments is found l London at work and play. Free use is ade of folk music, always a feature of aughan Williams. And when it is all ver, we are aware that it is done, adeuately concluded, a musical spell now ompletely over.

I recommend this symphony without eserve. It is one of the best in British usic.

JAN PEERCE, Tenor with Victor Symony Orchestra—"Lucia Di Lammeroor"—Tomb Scene, Act 3, Scene 3 Donizetti). With Arthur Kent, Bassaritone, and Chorus, in Parts 3 and 4 ung in Italian). HMV ED.565/6.

A splendid recording of Jan Peerce—I ink quite the best I have heard to date. e is well suited to this romantic-tragic usic. A true Italian style tenor, he avoids e pitfalls so often exhibited by names etter known than his. He has fine uality, robustness, range, and a really ood dramatic sense. This enables him to oid too close contact with the meloamatic in music which comes perilously ose to it. If you like your opera in this in, here is outstanding singing and cording. With a climax to thrill you.

PAOLO SILVERI, Baritone with Royal pera House Orchestra, Covent Garden—agliacci—Prologue" (Leoncavallo) (2 rts) (in Italian). COLUMBIA DOX.906.

Good, this, marred only by the singer's ndency to excessive vibrato. I fear pollo Granforte will always be my uchstone in this music, and even he uld sing off the note. A voice of fine ality and well used. This is the real ologue, as against some former recordgs which honored popular singers rather an the music.

LONDON PHILHARMONIC ORCHESRA. Conducted by Basil Cameron—"Peer Gynt Suite (No. 2)" (Grieg) (Intro: Ingrid's Lament; Arabian Dance; Return of Peer Gynt; Solveig's Song). DECCA Z.895/6.

Quite the best recording of this music released to date, technically certainly, and probably musically as well. The orchestra sustains the slow lament which runs through the whole suite, and is splendid in attack in those stabbing bursts Grieg loves so much. All round, I give it very high marks.

HARRIET COHEN AND THE PHILHARMONIA ORCHESTRA. Conducted by Walter Susskind—"Concerto in D Minor for Piano and Orchestra" (Bach). COLUMBIA DOX.898/900.

The quality of the recording is beautifully smooth, and the atmosphere is definitely Bach, even if it is a woman's Bach. The second movement disappointed me a little, but other sections, particularly the last, made up for it. The piano-to-orchestra balance is as I like it—clearly defined and yet playing as a whole. Music as only Bach can write it. She's a fine pianiste.

EILEEN JOYCE, Pianiste—"Sonata No. 12 in F Major, K332" (Mozart) (3 parts), and "Romance in A Flat Major, K.anh. 205" (Mozart). COLUMBIA DOX.904/5.

The music is beautiful to hear, but to me the nervous tension seems a little high for Mozart, whose music is surely essentially relaxed. But there it is, the notes flow from this woman's fingers like a sparkling shower. I have never known her to make the slightest concession to technicalities. And if she does put the pressure on now and then, maybe you like your Mozart that way. She certainly makes it sound convincing. One looks forward to hearing her again in person.

ANDRE KOSTELANETZ AND HIS ORCHESTRA — "Warsaw Concerto." COLUMBIA DOX.902.

Not very successful, and hard to see why it should have been played without the essential piano. However, the public seem able to take Warsaw music in every possible form, and this is certainly far from the worst.

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ANSWERS TO CORRESPONDENTS

HOW TO SUBMIT YOUR QUERY

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes and cut-outs will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C
GPO, Sydney.

F.E.S. (Bunbury, WA), sends in a subscription to "R. & H." and mentions that he has had good results with Fireside Five

A. Many thanks for the subscription and we are glad to hear of your success with the receiver.

B.A. (Ivanhoe, Vic.), wishes to use an 807 in the PA5 amplifier and sends in a portable circuit for comment.

A. You could use an 807 in place of the 6V6-G in the PA5 circuit. The correct cathode resistor is about 200 ohms. Provision would need to be made for accommodating the extra current drain and stopping resistors of about 5000 ohms in the grid lead and 100 ohms in the screen lead would probably be found necessary to prevent parasitic oscillations. The portable circuit does not provide for a means of detecting the signal before passing it on to the audio amplifier. Another stage would also be necessary to provide reasonable gain. We suggest you follow one of the conventional 3 or 4 valve circuits which has been tried and tested and can be depended on to give good results.

H.K. (Woollahra, NSW) expresses his approval of the beginners' section and sends in some suggestions for future articles. He also asks a few questions about the 807 Radiogram which he intends to build in the near future.

A. Many thanks for the kind remarks and we will keep your suggestions in mind. A tone control stage could be added to the Radiogram and in that case it may be an advantage to have the power supply on a separate chassis. The two chassis have to be conected together and some experimenting undertaken to avoid feedback troubles. You could connect a carbon microphone through the pick-up terminals and it would become operative when switched to pickup. A transformer and battery are necessary as usual. A special circuit would be necessary for satisfactory mixing of both channels. The baffle design you have enclosed should be quite effective although a fair amount of work is involved in the construction.

R.G.T. (Nth. Williamstown, Vic.) offers some constructive criticism of "Radio & Hobbies" and sends in a circuit copied from an American magazine for comment.

A. Glad to note your interest in our magazine and we will keep your remarks in mind. While at first glance the circuit would appear a good proposition it would be found to have many disadvantages in practice. It is actually a two-stage audio amplifier which may be switched either to a pickup or a crystal set tuner. When used on radio the selectivity and sensitivity would be found very poor. A much more practical idea to our way of thinking is to use the triode section of the 1D8-GT as a regenerative detector and the penthode section as an audio amplifier. The pickup could then be fed into the grid of the pentode section via a potentiometer.

This arrangement would give ample volume from the pickup without compromising the performance of the tuner Type 1D8-GT was found to be somewhat unreliable under service conditions and local production has discontinued. Replacements may be difficult to obtain at a later date.

C.A. (Ravenshoe, Q'land.), is interested in the articles for beginners and suggests that we should strive for the utmost simplicity in our articles.

A. We appreciate your sentiments, C.A., but have to limit the space allotted to articles and illustrations because of the present paper position. However, we are planning to follow some of your suggestions, which have also come from other readers.

G.C. (East Malvern, Vic.), reports having built the "105-One" and asks a number of questions about it.

A. The set appears to be operating well enough as you are able to receive all the local stations. Nevertheless, it should do better than a crystal set, no matter how good the crystal set was. It is not so much a matter of volume as the ability to receive a larger number of stations. Some broadcast stations send QSL cards for correct reception reports, but not all. There is no objection to leaving the can off the tuning coil if the receiver works better that way. However, this would apply only to a small regenerative set, as the same treatment to a larger receiver would probably promote uncontrollable oscillation as well as upsetting the tracking. The high tension battery will last quite a long time, but the life of the usual torch cell as an A battery would be counted in hours, depending on the periods of operation for the set.

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S.G. (Coburg, Vic.) sends along his congratulations to "R. & H." magazine for "the many fine constructional articles published." He suggests that consideration be given to the description of an A-C operated signal tracer with visua indicator.

A. Many thanks, S.G., for your remarks. A signal tracer was described in the July and August, 1943, issues of "R. & H." magazine. This tracer incorporated visua indication, employing an electron ray indicator. However, we are anticipating that a description of another signal tracer will be published sometime during the forthcoming year.

A.G.L. (Elimbah, Qld.) is pleased with the results he has had with a small set similar to Tex. He would like to know the correct needle weight for a crystal pickup.

A. Many thanks for your letter and the results certainly speak for themselves. We might suggest that the reaction control would be more effective if a 0.000 condenser was used to bypass the junction of the reaction winding on the reinartz coil and earth.

The optimum needle weight for a crystal pickup is usually about 2½oz. If it is made any less than this there is a tendency for the needle to jump from one groove to the next on loud passages, or to chatter badly.

H.H. (Manly, NSW) would like to know why there are no short wave battery portables available.

A. The main problem with a portable set operating on the short wave band is maintaining reliable oscillation of the mixer valve. At the present stage of valve development the best solution might be to provide a separate oscillator valve. This would mean a substantial increase in the cost and considering the limited demand, manufacturers haven't as yet considered it worth while to turn out such a set. Many thanks for the kind remarks.

W.H. (Moruya, NSW) has been interested in radio only for a short period and would like to know where to connect the earth leads and where to use tinned copper wire in a small set like the "IK5-One."

A. The earth signs in the circuit diagram indicate that the leads in question are to be connected to the chassis at the nearest convenient point. Tinned copper wire can generally be used for this job because insulation is not necessary. If a terminal is then connected to the chassis the latter can be connected to earth. A piece of water pipe buried in the ground makes a good earth or simply clamp the bare wire around the nearest water pipe to make an electrical connection. A special series of beginners' articles began with the November issue and you should find much of interest in this section in the future.

W.E.K. (Waikerie, SA) has just completed the 1947 "Advance" and finds that it performs excellently on the broadcast band but the results on short wave are not at all satisfactory. Also asks question about slug-tuned coils.

A. We would suggest, W.E.K., that you completely check the alignment of the set, particularly on the short wave band and preferably with a signal generator and output meter. If the set functions quite well on the broadcast band, there is no particular reason why it should not perform satisfactorily on the short wave band if the coil unit is okay. Check the contacts on the wave-change switch in the short wave position. There is no essential difference in coil kits of the same type between those sold over the counter and those supplied to manufacturers. Variable slug-tuned coils are preferable to the previously marketed type because of higher Q and the facility for adjusting the inductance. For general short wave coverage, it is cheaper, easier and less exasperating to purchase ready made and aligned coils than to attempt to wind your own. For communication receivers for use on the amateur bands, it is a different matter, mainly because there are few, if any, suitable coils kits available and provision for bandspreading is a necessity.

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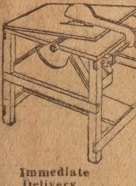

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ANSWERS TO CORRESPONDENTS

B.K. (Sth. Melbourne, Vic.) has seen some articles in American magazine on treasure finding devices and is keen to apply the ideas to gold prospecting. He would like to see "a radio circuit that squeals so that it can be made into a musical instrument by waving hands."

A. We have seen the devices you refer to but have always been doubtful as to their actual worth for prospecting. Most of them have a novelty value only and are more successful at locating water mains than gold nuggets. A musical instrument as you suggest would present no insuperable difficulties from the radio point of view but again falls more into the novelty class. We doubt if sufficient readers would be interested in the scheme to warrant all the work involved in designing and building such a device.

R.L. (Five Dock, NSW) asks a question about a reaction condenser.

A. Yes, R.L., condensers for tuning and for the control of reaction are similar, except for the value of capacitance. A reaction condenser usually has a capacity of approximately 100 mmfd. This means that it has smaller plates or a smaller number of plates than the type used for tuning. These remarks apply mainly to broadcast band receivers. Short wave receivers often use lower capacitance tuning condensers, so that both tuning and reaction condensers could be of the same size.

A.J.B. (Strathalbyn, SA), writes his approval of the "Shortwave Handbook" and offers a suggestion that the next edition should include European, American and Asiatic stations.

A. Thanks for your letter, A.J.B., and for your suggestions. We already have quite a few ideas for the next edition.

K.S. (Merewether, NSW), sends in interesting details of his experiments with inexpensive recording gear. Instead of the normal traversing mechanism he uses a 12in. disc as a guide for the cutting head.

A. Many thanks for your letter which was read with interest. Your method is certainly simple and the results apparently quite good. We will keep your letter in mind when considering simple methods of recording.

A.B.L. (Mosman, NSW) is keen to build the "Handie Talkie" after having heard several favorable reports from independent sources. He would like the chassis and cabinet dimensions.

A. Ready stamped chassis are available in the radio stores now, but we can supply you with a blueprint of the chassis and cabinet through our postal query service on receipt of 2/6. We note your suggestion with regard to the beginners' section.

J.W. (Mooroopna, Vic.), sends in for a copy of the Shortwave Handbook and mentions that he has had good results from the "Handie Talkie." He was also very much impressed with a 1947 Radiogram he heard recently.

A. The handbook will have reached you well before you read this. We hope you have many more hours of enjoyment from the little set which we agree "works like a champion."

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BUILDING A SIMPLE MULTIMETER

(Continued from Page 49)

ohms. If appreciable resistance is introduced between the test prods, something less than one milliamp will flow through the circuit and the meter will thus read less than full scale. If the meter face is suitably calibrated, the resistance value can be read off directly.

Most meters are calibrated these days for use with a 1.5 volt cell, and they are distinguished by the fact that the reference numeral 1.5 appears at exact centre of the ohms scale. It may alternatively be shown as 15, 150, or 1500, but it is intended to represent 1500 ohms.

If your ohms scale has 4.5 at the centre point, it is intended for use with a 4.5 volt torch battery. You will have to replace the 1000 ohm fixed resistor with a 3000 ohm unit, and the 1000 ohm potentiometer with a 2500 ohm unit. A scale based on a 4.5 volt battery is probably the better of the two, as it gives somewhat better indication on high resistance values. However, there is not much to it, and we suggest you use the scale which happens to come to hand.

COMPONENTS

Now a few words about the individual components. The switch used in the original multimeter was of rather ancient pattern, although quite satisfactory for the job. You may have a substitute on hand or be able to purchase one new. Try hard for a 2-pole 6-position, preferably arranged on a single bank. There are such switches in existence, although they are less common than the 2x5 variety.

If you have to use the 2x5 variety, you could possibly omit one voltage range and arrange the other two to suit yourself. For work on battery sets, a 10-volt and a 250-volt range would suffice. For a-c receivers and amplifiers, a 25 and 500 volt range may be more handy. These would involve resistor values respectively of 10,000, 25,000, 250,000, and 500,000 ohms.

Some meter manufacturers will supply accurate multiplier resistors to order. Alternatively, your dealer may be able to acquire selected 1-watt carbon resistors from the distributor to an accuracy of 1 or 2 per cent. Yet another course is to obtain a number of 1-watt resistors, of the correct nominal value, from any available source, selecting one which gives an accurate voltage reading, when compared with another voltmeter.

SHUNTS

The shunts are a more difficult proposition, since they are low and non-standard values, requiring to be related to the precise resistance of your meter movement. An experienced enthusiast can wind his own shunts, if another accurate meter is available for comparison, but the best course is to order the shunts from local meter manufacturers. He will need to know the meter resistance, derived either from the make and type, or the figure may appear on the face. Failing that, the meter may have to be forwarded for individual measurement.

The potentiometer can be either carbon or wire wound, while the battery is a standard small torch cell. This was held in place in the original instrument by a couple of wire clips soldered to the cover of the potentiometer. Please yourself how you mount it, but don't leave it floating around inside the case, to short to bare wires or lugs.

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FOR SALE: New Rothermel cryst pick-up. Best offer. **Robinson, Ethel St., Burwood, N.S.W. UJ4310.**

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FOR SALE: Palec V.C.T. valve and circuit tester 250 A.C., £19, also Rytim electric alarm clock, 250 A.C., 50 cycle £2. Will consider exchange for P. speaker, etc. **H. Brooks, Bailey stree Coolgardie, W.A.**

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